The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. VIII. No. 209 JUNE 16, 1923 Prepaid Annual Subscription United Kingdom, $1.1.0; Abroad, $1.6 0.

Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

The prepaid subscription to THE CHEMICAL AGE *is 21s. per annum for the United Kingdom, and 26s. abroad. Cheques, Money Orders and Postal Orders should be made payable to Benn Brothers, Ltd.*

Editorial and General Offices—8, Bouverie St., London, E.C.4

Telegrams: "Allangas, Fleet, London." Telephone: City 9852 (6 lines).

Research on Industrial Oxygen

THE paper on "Industrial Oxygen" which was presented last week by Mr. T. Campbell Finlayson at the opening meeting of the newly formed Institution of Chemical Engineers is worthy of remark for two reasons, quite apart from its being the initial paper of a new Institution. First, Mr. Finlayson's paper is notable for its comprehensiveness and length (it occupies 75 pages, almost the size of those in this journal); secondly, it is unusual in being a full account of research carried out primarily for industrial reasons by a commercial firm. The firm in question, the Woodall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd., are to be congratulated on their public spirit in permitting the free publication of this valuable work. If more firms followed their example we should be farther on the way to progress. The free publication of research has always been accompanied by the development of knowledge, while the old idea, by no means yet dead, of keeping any discovery secret for the benefit of the discoverer has nearly always hampered progress and brought but little benefit to the discoverer. It is almost an axiom that inventors reap little benefit from their own inventions.

Though the aim of the work in question, namely, to find a means of producing oxygen industrially at a price of one shilling per thousand cubic feet, has not been realised, this makes little difference to our contention. A very large number of possible methods were investigated. Some were found fairly promising and many quite practicable, but not within the very stringent limits set for the working cost. When it is remembered that oxygen produced by the present methods from liquefaction of air costs something between 3s. and 4s. per thousand, it will be seen that any chemical method would be impossible. The investigation of the possibility of the use of hæmoglobin (the active constituent of blood) as an agent for absorbing and concentrating the oxygen shows that the research was conceived in a most generous manner. Actually the most promising method turned upon the differential solubility of oxygen and nitrogen under pressure, in different liquids. Though this was not finally considered practicable, Mr. Finlayson states that the discovery of some more suitable solvent may put the matter in a different light.

If the production of cheap oxygen were made industrially practicable it is hardly too much to say that the consequences are limitless, for undoubtedly new uses would be found for it, but there would be many applications which could be taken up immediately. Apart from the application in gas-making, which was the actual object of the research, there would seem to be immediate prospects of the use of oxygen-enriched air in the burning of inferior fuel or ashes, while there are some attractive possibilities in metallurgy. The production of high temperatures for oxy-acetylene and similar work would be cheapened, while it has more than once been suggested that the production of cheap oxygen would throw a different light on the production of synthetic nitrogen compounds. Those responsible for the work which has been done deserve congratulation, although success has not yet been achieved.

With respect to the Institution of Chemical Engineers itself, the promoters are acting wisely in feeling their way in quite a new field. Already as the result of discussion it has become clear that a fundamental training in the sciences of engineering, chemistry, and physics must be the basis of any later specialisation. The exact balance between the academic and the practical sides is not always easy to maintain. It is true that the highest titular distinctions may come to very little when subjected to commercial utility tests; on the other hand, without the necessary knowledge of theory the most practical man is imperfectly equipped. Presently experiment may discover the secret of effective combination, and for the moment the Institution is pursuing a properly cautious policy. The Institution is now at least in being; its membership already indicates a need for such a body; it has the enthusiastic support of some very active minds, and it has a great field of service before it.

Comparison of Water Gas Systems

THE reports which are issued from time to time by the Fuel Research Board usually differ in one very important respect from the stereotyped form of official publication. In the first instance the Board is mainly served by the staff which has been through the mill and has, therefore, a thorough conception of practical requirements, while with a full-size technical station at its disposal it is able to study conditions just as they arise on industrial works. The result is that we are invariably provided with information and data which can be turned to immediate account.

The Board has just published a technical paper (No. 6) which relates to a series of experiments which have been conducted with water gas plant with the view of determining the particular set of operating conditions which are likely to give a maximum of efficiency. The Board exists primarily, of course, for the study of all problems relating to the conservation of our fuel resources and the better utilisation of fuel, and it is not difficult to appreciate the significance of water gas manufacture when it is recalled that probably 500,000 tons of solid fuel (coke) are utilised for the purpose each year in this country alone. The water gas process is exceptionally convenient, and, by reason of the small amount of labour it entails, it may be regarded as one of the most economical methods for the production of industrial and domestic gas. It cannot be pretended, however, that the process is altogether efficient, this being largely the result of the fact that it has necessarily to be operated on intermittent lines, and demands an extravagant period of heat replacement commonly called the "blow." Perhaps some day we shall run across a solution of the problem of producing cheap oxygen, and then the dreams of a continuously operated water gas process will materialise. Until then, however, we can do no more than improve upon existing efficiency by endeavouring to find the optimum conditions for such details as the operating cycle, depth of fuel bed, recovery of waste heat, etc.

It is with details such as these that Captain Fraser Shaw and Mr. J. G. King, who have prepared the recently issued Report, have been mainly concerned. An interesting point to bear in mind is that in this country our water gas plants are almost solely constructed and operated on the original Lowe principle, *i.e.*, with a deep fuel bed and a blowing period of comparatively long duration. On the Continent, however, the conditions are usually reversed, and in the well-known Dellwik plant it is customary to employ a shallow fuel bed and a short positive blast. There has always been a good deal of curiosity in this country as to the actual merits of the Dellwik process as compared with our own and the common American systems, and the main feature of interest in the Fuel Research Board's Report is the disclosure that the water gas plant at the East Greenwich experimental station has been operated on both systems to enable a careful comparison to be made between the two. Extremely close observation has been made in both cases, and from a table of overall efficiencies which the authors of the Report have drawn up little, if any, difference is to be found; in fact, in one set of experiments the net efficiencies are identical. A great variety of data is given which will provide long and profitable study for those who are actually associated with the running of water gas plant, and perhaps the most interesting is the table of carbon balances. The main point which emerges from a consideration of the distribution of the carbon in the original fuel is that during the "blow" rather more fuel is utilised than during the period of gasmaking. Stated in other words, only about 46 per cent. of the total carbon supplied is turned to actual account.

A British "Colour Index"

THE new British "Colour Index," which, we understand, is now approaching completion, promises to be one of the most notable achievements of the Society of Dyers and Colourists. The need of a thoroughly up-to-date and comprehensive index of dyes is admitted, but up to now the best available authority has been a German pre-war publication, now far from complete. The stoppage of German supplies of dyes during the war led to the rapid development of existing colour works in other countries and the establishment of important new works. Great strides have thus been made in the production of dyestuffs, and many firms are placing on the market dyes which have new commercial names, but which may not be new in constitution. A number of these are replicas of the German products with which users had become familiar. In the absence of definite knowledge as to their constitution, the dye-user has been at a disadvantage in selecting his dyestuffs, and has been confused by the multiplicity of products submitted to him. From a dye-user's point of view, therefore, it is a matter of great importance to know all the different commercial names used to denote the particular dye he requires, and the firms who make such products. No such information has been available, for the most comprehensive work of reference on the subject was the *Farbstofftabellen* of Dr. Gustav Schultz, published in 1914, which necessarily lacks information with regard to the great developments which have taken place in this and other countries during the past nine years.

In order to remedy this defect, the Society of Dyers and Colourists, whose headquarters are at Bradford, decided to undertake the work of compiling the present Colour Index. The arduous work of editorship was placed in the hands of Dr. F. M. Rowe, of the Manchester College of Technology, assisted by Mr. C. Lea, and a revision committee was formed under the chairmanship of Mr. Ernest Hickson, of Bradford, on which the leading dyestuff manufacturers and dyestuff users of all classes were represented, as well as leading professors and experts on the technical side. The Colour Index has been published in monthly parts, the first being issued in September, 1922. In order to ensure the greatest possible accuracy, 150 copies of the proofs of each part are circulated throughout the world to colour manufacturers, colour users, and technical experts, and the corrections and suggestions thus embodied have been exceedingly valuable. Fourteen parts are required to complete the Index. The ninth has been issued, and the matter for the remaining parts is now in the hands of the printers. The end of this great undertaking, therefore, is now within sight, and

there is no doubt that the remaining five parts will be published before the end of 1923.

One of the features of the Index when completed will be its comprehensive indices. These will cover the names of many thousands of commercial dyes, and will also deal with the patent numbers, the intermediate products used, and so on. Some idea of the magnitude of the undertaking may be gained from the fact that the number of distinct synthetic dyes dealt with will exceed 1,320, as against the 1,000 dealt with by Schultz. Most of these dyes have a number of commercial names—many of them thirty or more—and in all cases these names and the respective makers are given. The products of over a hundred colour-making firms are included, and the matter covers 700 large quarto pages of closely printed and condensed matter. A dye user who requires a particular dye can thus find a complete list of the manufacturers who make it, the scientific name of the product, its components and formula, details of its preparation, its discoverer, exhaustive references to the literature on the subject, its properties, uses, and modes of application. In addition to the synthetic dyestuffs the Colour Index will include the principal colouring matters and the pigments.

Wireless Talks on Chemistry

The British Broadcasting Company, with whom we have been in communication, appear to be quite favourable to the idea of broadcasting popular talks on chemistry, and the only difficulty about making a start is the selection of the right type of lecturer The qualifications are understood to be a clear voice, an intimate knowledge of the subject, and a gift of stating things in a picturesque way and in language that would be understood by the people. Chemical formulæ, one can understand, might not be quite suitable matter for transmission. One thinks at once of several gentlemen who might usefully employ an occasional evening in telling the public something about chemistry There is the unfailing Mr. Woolcock, who could charm them with stories of what the Dyestuffs Act has done, and convince them, without their knowing it, that it was the one thing necessary to save the country There is Dr. Stephen Miall, who could tell them all about the atom or the problem of solution or the deeper joys and sorrows of the editorial life. Dr. Ormandy is another unfailing source of enlightenment and entertainment, who might safely be trusted not to send his hearers to sleep. There are, in fact, a host of people whose services might usefully be employed, and the British Broadcasting Co. would probably be glad to hear from any of them who have bright ideas on the subject.

S. C. I. Finance

The balance-sheet of the Society of Chemical Industry for the year ended December 31, 1922, confirms the treasurer's warning at the last annual meeting that the position then probably looked more favourable than it was. The profit balance, which the previous year stood at £3,747, has now fallen to £580. The latter figure is not in itself unsatisfactory, for huge balances in hand are apt to induce sluggishness, while narrow ones stimulate activity. The income for the year is lower from most sources, the decline in the receipts from advertising being the most notable. In spite of the decline in revenue, the editorial expenditure on the journal is higher, but in some departments economies have been effected, and it is satisfactory to see the grants to sections and to other bodies on the increase. The strength of the Society really lies in a large membership, and the only way to increase membership is to let the public know what the Society is doing for the public welfare. The reversal of the Society's policy on this point might well be raised at the annual meeting at Cambridge, which, though shorter than usual, promises to be full of interest.

Points from Our News Pages

Dr. H. A. Prager contributes an article on "The Recovery of Fuel from Ashes" (p. 638).

An article from a works chemist is given on "The Elimination of Waste" (p. 641).

At the first meeting of the newly-formed Institution of Chemical Engineers on Friday, June 8, a paper was read on "Industrial Oxygen" (p. 642).

The London chemical market is described as quiet, but with few exceptions prices are very firm (p. 655).

There has been some improvement in trade during the past week, according to our Scottish market report (p. 658).

Book Received

Absorption of Nitrous Gases. By H. W. Webb. London: Edward Arnold and Co. Pp. 372. 25s.

Comparisons of Some Methods of Running Water Gas Plant. Technical Paper No. 6. By James G. King and Engineer-Captain J. Fraser Shaw. London: Department of Industrial and Scientific Research. Pp. 30. 2s.

Chemistry: Inorganic and Organic, with Experiments. By Charles Loudon Bloxam. London: J. and A. Churchill. Pp. 832. 36s.

Modern Gas Producers. By N. E. Rambush. London: Ernest Benn, Ltd. Pp. 545. 55s.

The Constitution of Matter. By Max Born. London: Methuen and Co., Ltd. Pp. 80. 6s.

Alcohol Fermentation. By Arthur Harden. London: Longmans, Green and Co. Pp. 194. 6s. 6d.

Practical Bacteriology for Chemical Students. By David Ellis. London: Longmans, Green and Co. Pp. 136. 4s. 6d.

The Calendar

June 16	Royal Institution of Great Britain: Atomic Projectiles and their Properties (Lecture VI.). Sir Ernest Rutherford. 3 p.m.	Albemarle Street, Piccadilly, London, W.1.
16 to 20	International Union of Pure and Applied Chemistry. Annual Meeting.	Cambridge.
19	Mineralogical Society: Meeting 5.30 p.m.	London.
19	ColourUsers'Association: Annual General Meeting. 12 noon.	Milton Hall, 244, Deansgate, Manchester.
20 to 23	Society of Chemical Industry: Annual Meeting.	Cambridge.
20	Society of Glass Technology. 2.30 p.m.	Leeds Institute, Cookridge Street, Leeds.
21	Chemical Society: Ordinary Scientific Meeting. 8 p.m.	Burlington House, Piccadilly, London, W.1.
29	Brunner, Mond and Co., Ltd.: Dinner to Celebrate the Fiftieth Anniversary of the founding of Winnington Works. 8 p.m.	The Hotel Victoria, Northumberland Avenue, London.

C

Recovery of Fuel from Ashes

By Dr. H. A. Prager

In our editorial columns recently we drew attention to the economy which results from the adoption on large works of processes designed to reclaim the combustible matter from the ash dumps. Dr. Prager gives some striking illustrations of the saving which can be effected, and describes the Ullrich magnetic plant which has been adopted quite extensively on the Continent.

THE conservation of the fuel resources of this country has not infrequently been urged. The increasing importance of the subject has led to the recent discussion in certain technical papers as to the necessity for the installation of plant, such as has been adopted by large industrial concerns on the Continent, for the recovery of fuel from ashes. Several Continental firms have been operating fuel recovery plants for a considerable time, and their profitable character has been undeniably established. It is known that the ashes from boiler, producer, locomotive engines and other such plants contain in normal cases 25 per cent. to 30 per cent. of combustible matter, and in cases where the control is less satisfactory the combustible content reaches figures as high as 40 to 60 per cent. Obviously here is a direction in which a definite and substantial contribution to the conservation of the coal resources of the country can be made. That the adoption of fuel recovery plants has not forced itself upon the attention of English manufacturers is little short of surprising. That the present is an opportune time for a most careful examination of the technical merits and financial possibilities of the recovery of fuel from ashes is undoubted.

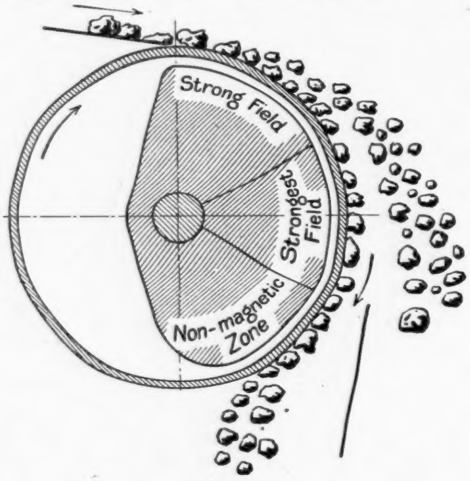


FIG. 1.

The writer, together with a representative of a large industrial undertaking, recently had the privilege of inspecting several fuel recovery installations working on the Ullrich Dry Magnetic System, and it occurred to him that readers of THE CHEMICAL AGE would be interested in the details of the working procedure and the financial and commercial aspect of such recovery.

The commonly known methods of fuel recovery are the so-called wet and dry processes. The former process has been well known for many years, whereas the dry process is quite a modern invention. More than half a dozen different types of installations have been constructed for extracting the combustible matter by the washing process (wet process), by which advantage is taken of the difference of specific gravity between the coke and the clinker. For certain ashes this method gives quite good results, but it is self-evident that the fuel recovered will be saturated with water (which may be as much as 25 per cent. of the total weight). Again, the washing process does not seem suitable for ashes containing a large proportion of fine breeze. Moreover, if the clinker is porous, the difference in specific gravity will not be sufficiently great to allow a clean separation, and the fuel obtained will be of a poor quality.

The Dry Magnetic Process

A method of separation based on an entirely different principle was established a few years ago as the result of the invention of the Dry Magnetic Process by Ullrich. This method depends primarily on the fact that practically every coal contains iron as pyrites. During combustion oxides are formed, and these pass completely into the slag. It was found that the clinker containing the iron oxides is attracted in high magnetic fields, whereas the residual combustible matter is not attracted at all. As the slag need only contain minute quantities of iron, the magnetic separation process is applicable for ashes from practically every kind of coal. A percentage of iron in the ashes of about 1·34 per cent., corresponding to a content of about 0·27 per cent. in the coal, is adequate. In this connection it should be noted that Fe_3O_4 is a thousand times more magnetic than Fe_2O_3.

The separation of the fuel from the clinker is effected on the periphery of a rotating drum, inside which are fixed two electro-magnets for the production of the magnetic field. As the ashes pass over the drum the slag is attracted by the field, whilst the non-magnetic coke is automatically projected over a partition and discharged into trucks. The underside of the drum is not magnetised, so that the clinker drops off and is thus automatically discharged (see Figs. 1 and 2). The separation is remarkably clean, and a high quality fuel, with a calorific value of about 11,000 to 12,000 B.T.U., is secured, irrespective of size, whether as coke or breeze. When it is remembered that breeze constitutes one third to one half of the total fuel content, it will be seen that this is one of the great advantages of the Dry Magnetic Process, as such breeze is largely lost in the wet process.

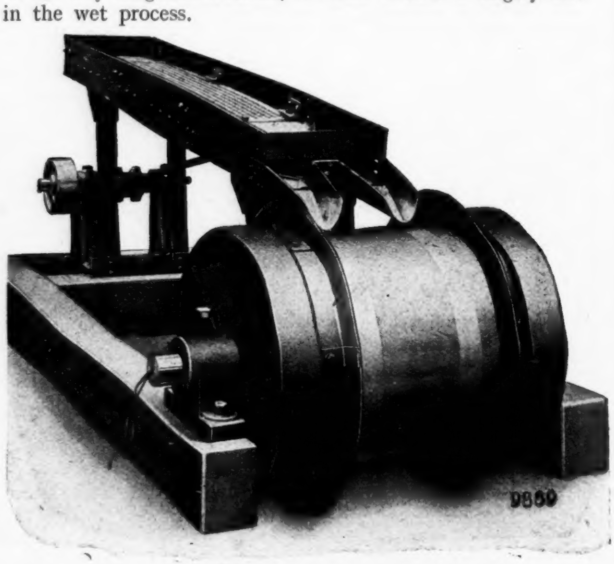


FIG. 2.

In order to avoid cartage expenses, the recovery plant should be erected in close proximity to the ash heaps. The ashes are charged into a hopper, from which they are evenly fed on to a bucket elevator by means of a shaking chute. The elevator conveys the material to a rotating conical screen, which separates the various sizes, as, for instance, 0 to ⅝ in., ⅝ in. to 1⅜ in., and 1⅜ to 3 in. The recovered fuel is thus obtained already graded. The ashes pass from the screen to the magnetic separator, and, after separation, the fuel and the clinker are discharged through chutes into trucks. Plants have been erected to cope with ½ ton to 20 tons of ashes per hour (see Figs. 3 and 4), one separating drum dealing with about 2 tons of ashes per hour. On an average, about 90 per cent. of the fuel content of the ashes is recovered. The power consumption for a small plant is about 1½ h.p. per ton of ashes treated hourly, and about ¾ h.p. for the same quantity in a larger plant. The magnets

are excited by direct current, the consumption being 0·7 to 1·0 kilowatt-hour per ton of ashes. A small plant could be run by two men, whilst three or four men would be required for the larger plants. This does not include the labour necessary for cartage of materials.

Financial Aspect

As has been already indicated, the Dry Magnetic Process is admittedly a well established operation, and the plant is

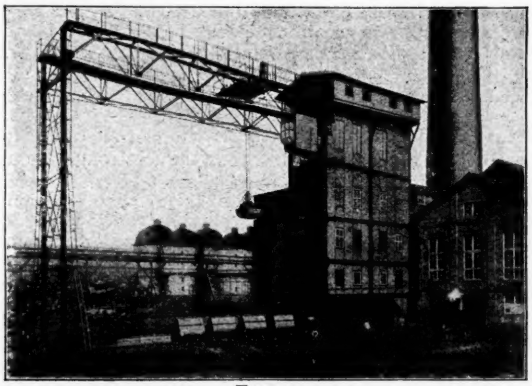


FIG. 3.

undoubtedly reliable and satisfactory. Any consideration of the financial aspect of the process depends essentially upon three main factors :—

i.—The character of the ashes to be treated.

ii.—The extent to which it is possible to utilise the plant throughout the full 24 hours of the day.

iii.—The labour required.

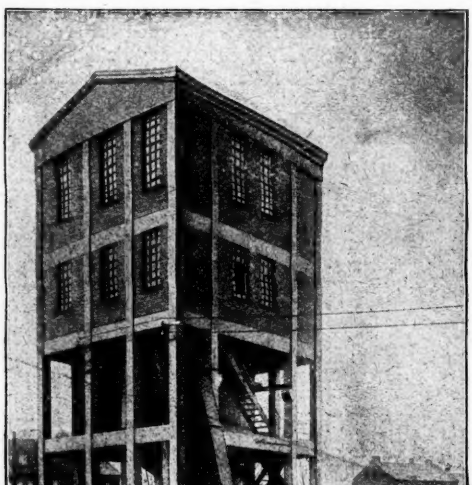


FIG. 4

The effect of these factors is made quite clear in the calculations, given later, of the cost price of fuel recovered. With the wave of economy that is spreading throughout the country, much consideration has been given to the question of how to lessen fuel consumption, particularly in industries such as chemical works, gasworks, steel works, power stations, railways, etc., where the annual coal consumption represents a large figure. With this end in view, attempts have been directed towards the maximum utilisation of the heat produced on combustion of the coal ; plant efficiency has been raised to a high degree ; the live heat of the escaping products of combustion has been utilised by the installation of waste heat boilers or other devices. Examples of the latter are to be found in connection with water gas producers, which have been so constructed as to take advantage of the live heat of the gas produced to generate all the steam required for the gasification and power consumption of the plant, even then there being an excess of some 30 per cent. for other purposes. The combustion of coal in such cases is made practically complete ; only 5 to 10 lb. of combustible matter being left in the ashes from 10 tons of coal. In most cases, however, this combustion efficiency cannot be attained. There must, therefore, be ashes containing the large percentage of combustible matter already indicated, and it is nothing short of wanton waste that such ashes should reach the waste tips and dump heaps of this country. It is certainly incumbent on those industrial undertakings which are at present discarding large quantities of ashes annually to visualise this question clearly and to realise its financial import. The two essential considerations are naturally the quality of the recovered fuel and the costs of recovery, and the best procedure is to have an average sample of the ashes analysed and treated in an existing plant, and to base the cost price of recovery on the result of the separation. This can best be illustrated by a few examples.

Example 1.

About 48,000 tons of ashes from producer plants are obtained per annum. The treatment of an average sample gave the following result :—

Grading Inches	Slag Per cent.	Coal and Coke Recovered Per cent.	B.T.U.
Over 1⅜	36·5	1·7	13,000
1⅜ to 0.........	42·0	20·0	11,000
Total	78·5	21·7	—

It would not pay to recover the fuel from the coarse mesh above 1⅜ in., and this after screening is accordingly not treated. Hence, 62 per cent. of the total ashes, *i.e.*, 30,000 tons, would be passed over the separating drums per annum. A 4-ton plant, working 24 hours per day, 300 days per annum, would therefore be sufficient for the treatment.

The cost price of the recovered fuel would be as follows :—

	£
Complete plant, say £2,000 ; 10 per cent. depreciation and 5 per cent. capital interest........................	300
Building, 20,000 c. ft., at 6d. c. ft.=£500 ; 3 per cent. depreciation and 5 per cent. capital interest...........	40
4 kilowatt-hours, 24 hours per day, 300 days per annum, at 1d. per unit.....................................	120
6 h.p.-hours, 24 hours per day, 300 days per annum, at 1d. per unit..	180
2 workmen per shift, 3 shifts daily. Total of 6 men daily at 10s. each, 300 days per annum....................	900
Repairs and attention to plant.........................	200
Overhead charges..	200
Total	£1,940

30,000 tons of ashes with a fuel content of 32 per cent. are treated. Taking the recovery yield to be 90 per cent., 8,600 tons of fuel (11,000 B.T.U.) are obtained per annum.

Hence, COST PRICE PER TON of recovered fuel=4s. 6d.

Example 2.

45,000 tons of ashes are obtained per annum from producer plants. Treatment of an average sample gave the following result :—

Grading Inches	Slag Per cent.	Coal and Coke Recovered Per cent.	B.T.U.
Above 1⅝.......	31·7	—	—
1⅝ to ⅝.........	14·9	17·4	11,500
⅝ to 0..........	25·0	11·0	10,400
Total	71·6	28·4	11,000 average

68·3 per cent. of 45,000 tons, *i.e.*, 30,500 tons of ashes, containing 42 per cent. of fuel, would have to be treated per annum. A 4-ton per hour plant would therefore be sufficient.

Cost price of recovered fuel :—

The total recovery cost would be the same as in Example 1.

Taking a 90 per cent. recovery yield, 11,500 tons of fuel (11,000 B.T.U.) are obtained per annum.

Hence, COST PRICE PER TON of recovered fuel=3s. 4½d.

Example 3.

110,000 tons of ashes from boiler furnace of chemical works are obtained per annum.

The treatment of an average sample gave the following result :—

Grading Inches	Slag Per cent.	Coal and Coke Recovered Per cent.	B.T.U.
3 to 1½	32·3	—	—
1½ to ⅜	8·85	12·75	11,800
⅜ to 0	24·5	21·6	11,600
Total	65·65	34·35	11,650 average

67·7 per cent. of 110,000 tons, *i.e.*, 74,000 tons of ashes, containing 50·5 per cent. of fuel, would be treated per annum. A 10-ton per hour plant would therefore be sufficient.

Cost price of recovered fuel :—

	£
Complete plant, say £3,200 ; 10 per cent. depreciation and 5 per cent. capital interest	480
Building, 40,000 c. ft., at 6d. c. ft.=£1,000; 3 per cent. depreciation and 5 per cent. capital interest	80
8 kilowatt-hours, 24 hours per day, 300 days per annum, at 1d. per unit	240
10 h.p.-hours, 24 hours per day, 300 days per annum, at 1d. per unit	300
3 workmen per shift, 3 shifts daily. Total of 9 men per day at 10s. each, 300 days per annum	1,350
Repairs and attention to plant	300
Overhead charges	300
Total	£3,050

Taking a 90 per cent. recovery yield, 34,000 tons of fuel (11,650 B.T.U.) are recovered per annum.

Hence COST PRICE PER TON of recovered fuel=1s. 10d.

Example 4.

If the ashes in Example 3 contained only 20 per cent. of combustible matter, only 13,500 tons of coke would be recovered.

In this case the cost price per ton=4s. 7d.

It may be mentioned that these examples are based on typical analyses of average samples of ashes from large industrial concerns. As has been shown, the cost of treatment of these ashes is so small that it is to be hoped that British conservatism will finally be overcome, and that in coming years the installation of fuel recovery plants will be common practice in this country. The coal consumption will thus be reduced by an evarage of 5 per cent., and in special cases by as much as 8 to 10 per cent. It will be noted that the combustible material in industrial ashes is contained mainly in the finer grade below 1⅜ in., so that often only two-thirds to a half of the total ashes need be treated in the separator. In these cases it is fully conceivable that the recovery of fuel from poor ashes will still prove profitable. The fuel obtained is generally of good quality. The coarser grade cannot be distinguished from ordinary gas coke. The smaller grade may be used with advantage in forced draught furnaces.

It should further be noted that the slag after the coke has been extracted is a valuable brick-making material which possesses a value of 2s. 6d. to 3s. per ton. Brick-making plants wherein the slag is utilised are usually combined with fuel recovery installations, and thus the financial aspect of the complete proposition is considerably more favourable. The manufacture of the slag bricks may be regarded as an important new industry. The bricks compare favourably in every respect with burnt clay bricks, and on the other hand they are considerably cheaper. A large number of houses and other brick buildings have already been constructed from them, and their hard-wearing properties have been proved beyond all doubt. The cost price of such bricks is dependent upon the erection of a modern and highly efficient plant. It may be of interest to the reader to know that the cost price of standard size slag bricks would be from 25s. to 30s. per thousand. By effectually utilising ashes in the way outlined, not only has the value of the fuel and the ashes, from the point of view of brickmaking, to be taken into consideration, but the expenses—in many instances not inconsiderable—hitherto incurred in the removal of the unutilised ashes to the " dump " or " tip " must also be taken into account.

Theories of Chemical Combination

Lectures by Professor Lewis

THE second and final lectures on the " Structure and Behaviour of the Molecule " were given by Professor Gilbert N. Lewis, of the University of California, at University College, London, on Friday, June 8, and Tuesday, June 12, Professor F. G. Donnan being in the chair.

The second lecture dealt with " The Colour of Substances," and Professor Lewis explained that the old theory of the colour was that the electrons in a given substance had a natural period of vibration, and when light radiation fell upon the molecule these electrons acted as resonators and sent out vibrations of a definite wave-length. That was a simple theory, but had not been confirmed. The latest theory was that there were certain " levels " in the molecule along which the electrons moved, and that the electrons were able to move from one " level " to another, giving out or receiving energy in the process which would correspond to emission or reception of light. This theory was necessitated by our modern ideas of energy as embodied in the " quantum " theory. This theory was being borne out in practice. For instance, it had been shown that such a process as the synthesis of ammonia showed distinct steps corresponding to evolution of energy, not continuously, but in " quanta."

The Electron Theory of Valency

The final lecture was entitled " The Sources of Chemical Affinity." The lecturer stated that in his opinion the electrochemical theory of affinity had reached its limit of usefulness. He pointed out that the phenomena of magnetism had an important bearing in this connection. The ordinary magnetic substances had free electrons in their molecules; in a sense they were " unsaturated." The saturated organic compounds conversely showed the phenomenon of diamagnetism (*i.e.*, the opposite of normal or para-magnetism).

There were two fundamental rules governing the grouping of electrons, which Professor Lewis called " the Rule of 2 " and " the Rule of 8." By " the Rule of 2 " he meant the tendency of the electrons in an atom to group themselves in pairs. If one was left over it would group itself with one from another atom, and there would be what was called a diatomic molecule, joined by a *single* bond. By " the Rule of 8 " he meant the tendency of the electrons in the outer ring of an atom to group themselves in a series of four pairs; and again, if enough electrons were not present in the outer ring to make eight, the tendency was to share electrons with those in some other atom, again forming a molecule and accounting for the formation of a chemical compound. A number of interesting slides were shown with diagrams of the arrangement of electrons according to these rules for many of the simpler compounds. The grouping into pairs and octets was clearly shown.

Application to Double Linkages

The new theory indicated that a " double linkage " would be unstable, since it would be formed by a group of *four* electrons, and would strain the atoms involved. The " triple bond " was a less reactive arrangement, as was borne out by common experimental facts. For instance, acetylene absorbed bromine less rapidly than ethylene. Other points of interest in connection with the electron theory of chemical affinity were that it indicated that " conjugated double linkages " were particularly stable, again in accordance with known facts, and the difference between such atoms as sulphur and oxygen was indicated, it being shown that sulphur would tend to link up to form complex molecules in chains of six or more, while oxygen atoms were satisfied in the diatomic molecule. The " carboxyl " radical associated with organic acids did not contain one doubly linked oxygen and one singly linked atom, but two atoms singly linked with the hydrogen shared between them, again explaining the observed fully-saturated character of this radical.

In proposing a vote of thanks to Professor Lewis for his course of lectures, Professor Donnan pointed out that much of the work referred to was Professor Lewis' own, and that in substituting the known electron for a theoretical " bond " as the basis of chemical affinity the lecturer had rendered a definite service to science.

The Elimination of Waste

By a Works Chemist

"THE Elimination of Waste" is a slogan which has been cried throughout the length and breadth of the United States, and it is well in these times of economic stress to crystallise our own thoughts upon such a matter.

It must be admitted that the many sources of loss in works operations are usually appreciated in this country; but their elimination often involves the expenditure of capital and demands the application of energy already strained to the utmost limit. It is none the less possible to be penny wise and pound foolish, and full consideration should be given to the subject in all its ramifications.

Illustrations are easy to find, in theory, but there are many instances of practical applications which prove the value of a striving after economy, even in times somewhat ill-suited to the elaboration of processes and plant. Successful waste elimination depends primarily upon the spirit with which the matter is approached, and it behoves us all to assimilate the gospel of true economy in works operations, and to drive out loss in its every manifestation.

At the root of the whole matter is a true appreciation of the *fact* of waste. This is only possible if efficient costing is practised. A costing system need not be elaborate to a high degree, but, carefully watched, it will show all possible openings for waste elimination. We need not labour this point in view of the extensive information available, notably in the Ministry of Munitions' publications.

The wastage of human energy is a vital point demanding close scrutiny. Not only in the transport and handling of materials, but in the manifold operations of works processes the application of labour-saving devices is true economy. Here, again, elaboration is unnecessary.

Waste Heat Recovery

The high price of fuel is a great incentive to all forms of economy. Nevertheless, there is no doubt that many steam boiler installations in chemical works are operating at low rates of efficiency. In these days of recording instruments of every description—meters, gas analysis machines, pyrometers, etc.—a complete survey of operating conditions can be made without effort, and firing conditions regulated and set. Efficient water softening is of the greatest importance, but is too often neglected—at any rate, in its highest degree. The recovery of waste heat from cement kilns, water-gas installations, high temperature furnaces, etc., by the generation of steam in "waste heat boilers" effects very considerable savings in fuel expenditure. Several water-gas plants recover sufficient heat from the "blow gases," etc., to generate all the steam required in the "make" periods. Similarly, an examination of the thermal balance of a cement kiln demonstrates the enormous amount of heat which escapes—ordinarily—from the kiln. These examples, obviously specific in their application, show the lines upon which fuel saving may proceed in this particular direction of waste heat recovery.

Colliery waste in the "fines" can be reduced by the application of coal cleaning methods, and the flotation and plastic fuel (Trent process) methods may be cited as instances of the reclamation of valuable fuel from what up to the present have been considered waste materials. Slate quarry waste should soon become a valuable by-product, and many applications of its use as a cheap "filler" in various directions have been indicated. Lubricating oil is capable of recovery after use by several simple methods, and high prices should only be conducive to the application of a suitable simple method.

Outside this country, too, many instances occur of waste elimination. We need but refer to the use of sawdust, molasses, and other waste carbohydrate-containing materials for the production of power alcohol. It is unnecessary to indicate more than a very few of the possibilities of waste elimination, but it must be clear that the field is almost infinitely wide, and it is the *will* to save from which all progress must originate.

Needless Duplication

Finally, the secrecy within which many of our chemical processes are enshrouded is not in the best interests of national industry, nor of waste elimination. Duplication of effort, in determining optimum operative conditions, and in research programmes, lack of specific information upon all essential points even if particular branches are carried on with specialised knowledge, and so forth, are a natural result of secrecy within any particular industry.

This has been the point of several recent utterances, and represents a feeling which is gaining increasing support even in conservative circles. It may be recalled, for instance, that at a meeting of the Institution of Rubber Industry some time ago, one speaker remarked that the industry was hedged about with secrecy. Each manufacturer had his own mixings, methods and processes. It was suggested that it would be far better if the whole industry met and discussed frankly their problems, and established a kind of clearing house for ideas. Similarly, in the iron and steel industry each manufacturer has his own methods. Probably no two makers use exactly the same methods, and yet all produce good steel. To take but a single instance, the question of casting temperature is a matter of controversy, some believing in the value of a high and some in the value of a low temperature. Advantages may be claimed for one or the other process, but one must be better on the whole. Only full and frank discussion can settle such questions.

These examples merely indicate the point under consideration. It should surely be clear that 100 per cent. efficiency can only be attained by combined effort, and although many difficulties must be faced in the consummation of the ideal, and the immediate publication of new processes and inventions cannot always be considered desirable, yet there is a great advantage to be gained from a careful system of pooling results. America provides a good example in this matter, for open discussion and frank reporting of progress is the rule rather than the exception. The disclosures of methods of gas warfare is typical, and the available records of war-time progress are significant.

It is the spirit and desire in the matter of waste elimination that is of moment, and a whole-hearted appreciation of the broad principles will go far in the smoothing out of the difficult path to true economy.

Chemical Trade in May

Satisfactory Improvement in Figures

THE overseas trade returns for May just published are the most encouraging since January, 1921. Reckoned in sterling, our exports reached a higher mark than in any other month of the past two years, but, in view of the heavy fall in values, the actual increase in trade is much greater than the bare figures indicate. The increase in dyestuff exports is remarkable, being more than double that of the corresponding month last year. The month's record may be summarised as follows:

Total imports, May	£89,478,996
Increase on 1922	£753,427
Total exports, May	£71,554,864
Increase on 1922	£13,509,511
Total re-exports, May	£11,773,426
Increase on 1922	£2,808,527

The imports of chemicals, drugs, dyes and colours are valued at £1,118,578, an increase of £249,415 on 1922 and £276,226 on 1921. Manufactured oils, fats, and resins show a figure of £3,375,057, a decrease of £602,464 on 1922 and £2,020,789 on 1921.

Exports show a satisfactory increase, being valued at £2,572,955 for chemicals, drugs, dyes and colours combined, representing an increase of £824,854 on May, 1922, and £1,492,538 on May, 1921. Manufactured oils, fats and resins also show an increase, the figures being £583,537, an increase in value of £60,211 on May, 1922, and £236,409 on May, 1921.

The following figures give the export of certain products for the month with the corresponding figures for May, 1922, in brackets. China Clay (tons), 49,473 (53,986); Oils, fats, etc., manufactured (tons), 19,022 (16,989); Coal tar pitch (tons), 50,523 (50,497). Soda compounds (cwt.), 942,353 (731,550); dyestuffs (cwt.), 16,599 (7,358); Painters' colours (cwt.), 142,864 (105,227).

Our usual detailed figures will be given next week.

Research Work on Industrial Oxygen

Discussed at First Conference of the Institution of Chemical Engineers

SIR ARTHUR DUCKHAM, the first president of the newly-formed Institution of Chemical Engineers, presided at the first corporate meeting of the Institution at the Engineers' Club, London, on Friday, June 8.

The report of the Provisional Council stated that there had been 205 applications for membership, of which 114 had been accepted by the Council, the remaining 91 being still under consideration by the Nomination Committee. Reference was also made to the fact that Mr. W. J. U. Woolcock had been elected the first honorary member of the Institution, and that the Council had decided to support the chemical section of the British Empire Exhibition next year with a donation of £25. The financial position was reported to be good, there being a substantial balance in hand. The remainder of the report dealt with matters concerning the formation of the Institution which have already been published.

Election of Officers

The following officers and Council were elected for the ensuing year : President, Sir Arthur Duckham ; vice-presidents, Dr. Charles Carpenter and Mr. K. B. Quinan ; hon. treasurer, Mr. F. H. Rogers ; hon. secretary, Professor J. W. Hinchley. Members of Council : Messrs. H. Talbot, J. Arthur Reavell, C. S. Garland, W. B. Davidson, Sir Alexander Gibb, W. Macnab, Col. Sir F. L. Nathan, James MacGregor and W. Newton Drew. Associate members of Council : Messrs. R. C. Browning, A. L. Booth and E. C. Randall.

The President announced that Mr. C. S. Garland had agreed to act as Registrar to the Institution until the appointment of a paid officer.

Sir A. Duckham's American Experiences

Sir Arthur Duckham related some of his experiences in America recently. America, he said, was the only country in the world that had endeavoured to train or to give a real curriculum for the chemical engineer. There was the closest touch between research and real industrial work. When he visited Boston he was absolutely oppressed by the magnificent laboratories, by the wonderful apparatus, and by the marvellous arrangements for the education of the young man and for giving reports and scientific advice to industrial people. While at Boston he did not see how this country of ours could possibly hope ever to compete with the Americans on industrial development on the chemical engineering side. But when one came to look into this development one began to feel that possibly the mental capacity of the American student would be somewhat overtaxed, and that possibly, when he went out into industry, he would have his brain so full of so many things that he would not really be so valuable a servant to industry or so valuable a helper in a works as if he had had a somewhat simpler education, such as we had in this country. He received from Professor Lewis, of the Massachusetts Institute of Technology, the very comforting remark that the students who had come over from England into his laboratories at Boston made greater progress and did better work in most cases than the American students who had been trained right through, and his reasoning was that our training in England was very much sounder in its groundwork.

Those in industry in this country knew very well that if anybody came and offered them a graduate from a college or university, with letters after his name and all sorts of distinctions, they did not immediately jump at him and say that he was the man they wanted to put in charge of their works. After all, when they got down to the bedrock of these chemical engineering problems they were all capable of pretty simple solution. When visiting American institutions he felt that the Institution of Chemical Engineers must be careful in any work that they might do as an Institution to assist the education of the chemical engineer in this country, to see that primarily the curriculum contained that absolutely essential grounding in first principles—in chemistry, mechanics, engineering and physics, because physics came into the problem just as much as anything else which was necessary for the making of a first-class chemical engineer. He hoped that the first work of the Council of the Institution would be to form a Committee which would endeavour to lay down such a curriculum or put forward ideas in connection with a curriculum for the training of a chemical engineer. They would want the fullest support from everybody. The Council had to get down to solid work in this matter, and when they could present to the Institution something definite in the way of a curriculum for education in this country, and, further, something definite as to the kind of work the Institution wanted to do in the way of papers and lectures, then the very strongest support of all the members would be wanted. As was well known, his keen wish in regard to the Institution was that it might be the means of drawing together very many of the existing societies.

Summary of the Paper

After a short adjournment, a further meeting was held, at which a paper on "Industrial Oxygen" was read by Mr. T. Campbell Finlayson.

Sir Arthur Duckham, who again presided, said that the paper was in a certain way connected with the firm of which he was chairman. It rather illustrated the method of carrying on industrial research which that firm adopted—for instance, it was considered that if what was called industrial oxygen could be obtained at a price of 1s. per thousand cu. ft. it would be of the utmost value to industry. Therefore his firm got Mr. Finlayson to undertake to carry out this research for them. A laboratory was provided for him, and he was left severely alone for as long a period as he wished to be, reporting at odd times and receiving suggestions or decisions as to the line the research should go on. The whole of the work in the paper was very largely Mr. Finlayson's work, although certain other people had made suggestions to him from time to time. Although the result of the research was that the firm did not proceed with the idea of the commercial manufacture of oxygen, it was well worth the money that was spent on it. The idea, of course, was not to produce pure oxygen, but industrial oxygen.

The Object of the Research

In opening his paper Mr. Finlayson said :

"The work upon industrial oxygen was instituted with the object of finding some simple process which would produce oxygen at a price not exceeding 1s. per 1,000 c. ft., and would involve low capital expenditure.

"Before starting experimental work an extensive search of the literature dealing with oxygen production was carried out. The search did not bring to our notice any process of air enrichment which we could accept as a useful line of work. Most chemical processes fail on account of thermal inefficiency. This failing, while tolerable if the oxygen is to be regarded as an expensive chemical, is out of the question from the standpoint of fuel economy.

"The reasons for the failure of the chemical processes are deep-seated and depend chiefly on the fact that at ordinary temperatures oxygen is very inactive, contrary to the common belief. At high temperatures oxygen functions as an exceedingly reactive element, and it is safe to say that many processes could be devised which would work at temperatures of 700° C.

"The chemical processes which take place at low temperatures are few in number. There are only two which seem at all favourable. 1. Absorption of oxygen by hæmoglobin, the active constituent of the blood of mammals. It is possible that a process might be worked out on these lines, but it seemed unlikely that large plants using hæmoglobin would be considered as an adjunct to gas making. 2. The interaction between nitrogen oxide to form nitrogen peroxide. This reaction goes on with great speed at ordinary temperatures, and if a method of isolating the oxygen could be devised when the reaction was reversed a very simple process would result. Up to the present no method of reversing the reaction without the intervention of some other working substance involving heat treatment has been found.

"The fact that the chemical processes appeared to be of little use led us to select physical processes of separation as the heat change in such processes appeared to be more satisfactory from our point of view.

Physical Methods

"There are a number of physical processes which would result in a concentration of the oxygen in air, the most useful of these appearing to be :—

"1. Liquefaction followed by fractional distillation. This method is in common use; its costs are known, and any development in this line seemed to be bound to come from those who are at present utilising the process. This line of work was not investigated for the above reason, and also on account of the cost, which is 3s. to 4s, per 1,000 c. ft.

"2. Solid adsorption. The adsorption of gases by some solids is a very remarkable phenomenon which would enable a separation to be effected by a process of fractional heating of the solid. The use of charcoal, the cheapest adsorbent, is almost out ot the question because of the conversion of the oxygen into carbon dioxide at comparatively low temperatures. The use of other adsorbents, whilst promising, seemed of remote value because of the difficulties of preparing them. These materials are such as silica gels and alumina.

"3. Diffusion. There are two types of diffusion which result in separation :—(*a*) Diffusion through porous bodies. This is an exceedingly slow and laborious method, depending upon the square root of the densities of the gases. As the densities are as 14 : 16 the separation is almost impossible. (*b*) Diffusion through thin films of liquid. This is in certain cases rapid, and results in a separation depending upon the differential solubilities, which is generally more favourable than the difference in densities.

"4. Solubility. Gases have different solubilities, and a process was suggested and tried some years ago for separating oxygen and nitrogen by this means. The original process, which involved compressing air in contact with water—allowing the gas dissolved to escape and re-compressing it a number of times—is useless as a method of procedure. It is too costly in power and plant.

Pressure Fractionation Process

"It seemed possible to introduce considerable simplification, and a process which has been named Pressure Fractionation was proposed. This process bears the same relation to the above discontinuous process as intermittent fractional distillation does to the use of a fractionating column.

"A very complete experimental investigation has shown that the process, which was arrived at from purely theoretical considerations, holds in practice almost exactly, and it is thought that this process is a definite advance on any previous solution process.

"The experimental work has shown how very marked is the influence of agitation on the rates of solution, evolution and attainment of equilibrium between solvent and gas. It has been demonstrated that with certain oils these rates are so rapid that the times involved are measured by seconds. Paraffin (lamp oil) was found the most satisfactory.

"Based upon this fractionation process, a supply of 30 per cent. to 40 per cent. oxygen gas could probably be obtained at a reasonable price, working upon the data already obtained.

Details of Apparatus

"The scheme for the fractionation process would be something as follows :—The plant consists of two vessels, each fitted with efficient stirrers and a gas offtake at the top. Each vessel is full of suitable oil and the agitators are running. Air is pumped into No. 1 vessel until the pressure is 135 lb. per sq. in. Further gas (blow-back gas) is pumped into No. 1 until the pressure is 150 lb. per sq. in. We thus have No. 1 saturated at 150 lb. with a gas containing about 22 per cent. oxygen ready for the fractionation. The fractionation is carried out as follows, equilibrium being regarded as existing throughout. The pressure is allowed to fall to 75 lb. The gas evolved is passed through the high-pressure blower for the recovery of as much power as possible, and is then blown to waste.

"The pressure is then allowed to fall to 36 lb. through the low-pressure blower, also for power recovery. This second portion is also valueless. The pressure is then allowed to fall to 20 lb. This gas contains about 25 per cent. oxygen, and is compressed and pumped into No. 2 vessel during the solution stage, this being the blow-back gas. The pressure is then allowed to fall to 1 lb. absolute, the gas evolved being of the mean composition of 40 per cent. oxygen. Means will have to be provided for the rapid evacuation of the oil down to this low pressure.

"The main cost of the process lies in the compression of air. A study of the economics of the process has shown that it is the cheapest to dissolve all the air compressed, and thus start the fractionation with 21 per cent. in solution. This start is the factor which determines the higher limit for the final oxygen strength. Thus, if we could start with 30 per cent. oxygen in solution, we should obtain a final oxygen of 60 per cent. to 70 per cent. strength. Various means of obtaining a large supply of cheap 30 per cent. oxygen have been examined. A scheme which we have called film filtration, depending upon filmed surfaces, with interior low pressures, has been investigated, but has not proved successful.

"A further scheme for improving the pressure fractionation effect in order to give strong oxygen gas at an economic figure has been considered. This depends upon the use of methyl or ethyl alcohols at low temperatures as solvent. According to some work it appears that the solubility of oxygen increases with fall in temperature, whilst the solubility of nitrogen decreases. In this way the differential solubility becomes greater, leading to a sharper fractionation. As far as our experiments go, it has been found that there is practically no advantage in carrying out the fractionation at low temperatures. Moreover alcohol is more expensive than oil, is more volatile and fractionates less efficiently. This line of improvement by using alcohols has thus been abandoned.

"Similarly experiments on the use of the readily liquefied gas as solvents for oxygen and nitrogen have also been abandoned, as an examination of the subject shows that any such process could harldly be said to come under the heading of simplicity or cheapness."

In concluding, Mr. Finlayson pointed out that the object of the research was not to make pure oxygen, but to provide an enriched air for use in gas-making, and he gave figures of the economy which would be expected in a water-gas plant if such an enriched gas were available.

Discussion

The PRESIDENT, in remarking on the paper, said that there were two names which he would like to mention. This oxygen research was really due, on the part of the company that did it, to the earlier work of Professor J. W. Cobb, of Leeds University. Professor Cobb and the company had had long discussions on this subject, and Professor Cobb's previous investigations had led the company to do the work. The second name was that of Mr. J. Stanley Morgan. Mr. Morgan was technical director of this work, and had given Mr. Finlayson a very great deal of assistance, and it must be recognised that many of these very ingenious methods of absorption and mechanical as well as other details were due to Mr. Morgan. The paper dealt with a type of work which was of interest to all of them, and a type which they wanted to see developed. There were the chemical, the physical, the electrical and the mechanical aspects of the affair ; and Mr. Finlayson had to be a mechanical engineer, an electrical engineer, a chemist and a physicist ; that went to show, once more, that if we were to get really first-class industrial work on the lines of chemical engineering a training in these basic professions was essential for any man who was going through with it. The only other point he would make was that this research was never intended to be a research on the obtaining of pure oxygen. It was a research for the strengthening of the mixture of oxygen and air, and that was all, and, so far as the research was concerned, the company would have been perfectly content to have had a satisfactory method of obtaining a mixture of oxygen and nitrogen containing from 50 to 60 per cent. of oxygen.

Vaporisation of Solvents

DR. R. LESSING congratulated the Institution on having had a paper of this kind giving the results of some most valuable research work. Whatever their result from the point of view in mind, the data contained in the paper would be very valuable for future use in work of this kind. Could the author say to what extent the solvents were vaporised and carried away with the concentrated gas? Particularly in the case of paraffin oil, one would imagine that a certain amount of hydrocarbon vapour was carried out with the gas. In cases where the oxygen might have been used for gasmaking purposes such a vaporisation of oil would not be a disadvantage, provided

the economic value of it could be realised again in gas form. The fact that oxygen up to 40 per cent. strength in a mixture could be obtained—and no doubt this had been considered by those making the research—might be of value in certain gas-making processes—for instance, in producer-gas making. Another point was whether there would be any advantage in using the process as a preliminary to pure oxygen making, taking the process mentioned in the paper, in which a concentration up to 40 per cent. could be obtained with low pressure as a first stage before the high-pressure process in Linde fractionation was gone through.

Mr. W. S. Milne asked if the author had considered using paraffin oil in the form of a solid emulsion, in which the paraffin would be the disperse phase, and some suitable solvent the continuous phase, the emulsion containing as much paraffin as possible. In that case the absorbing medium was in a very finely divided state.

Use in Gas Producing Questioned

Mr. D. Brownlie, after congratulating the Institution on the quality of its first paper, said the point that interested him was in connection with producer gas and water gas. He would assume for the moment that it was possible to make oxygen at a price of 1s. per thousand cu. ft., because he felt that some day somebody would come along and get the right method of doing it at this price ; but, assuming this, what was the advantage of it ? If they were going to increase the oxygen in the air blast, they would enormously increase ash troubles. The first trouble would be increased coking, not to say increased wear and tear of the fire-brick lining, and a few other little troubles which occurred in general producer gas work. He quite admitted that if the oxygen in the air blast was increased it was also possible to put up the steam, but it was going to be a very delicate operation. It was stated in the paper that the efficiency of a water gas plant was 56 per cent., and that if oxygen were used the efficiency of the gasification plant would be increased to 90 per cent., but he was not clear about this. In the first place, he did not see why the author should take the ordinary, common water gas plant, which in any case was getting out of date. Any self-respecting man used the blow gases partly for generating steam, and it seemed to him, therefore, that it was hardly fair to take the efficiency of the water gas process at 56 per cent., even when using water gas in gas making. Moreover, water gas to-day was also being used more and more for heating purposes, and we should therefore take, as well, the hot gas efficiency. But surely the interest of the oxygen question to-day was not in the old-fashioned water gas plant, but in the modern gasification processes, and he did not see how oxygen was going to help very much.

Dr. Goodwin (Canada) said that there was a curious discrepancy in the rate of solution of oxygen in water as compared with other solvents. He had been struck with the point that the addition of soap caused a more rapid evolution and, on the other hand, retarded the solution of the gas. He had had a great deal to do with experiments on absorption, and he thought that in the washer, as constructed, it would be an exceedingly difficult matter to say whether they were dealing with water or water with an oil film on it. He did not see how the stuffing boxes could be made sufficiently tight to prevent slight traces of oil in the water. It was just possible that the slower rate of solution was due to traces of oil, and this appeared to be confirmed by the effect of higher rates of solution in methyl alcohol and oils, which were, of course, solvents for oil.

Outlets for Industrial Oxygen

Mr. C. S. Garland said that in 1913 experiments were being made in Berlin on the use of oxygen gas for lighting the streets, in conjunction with the zirconia filament, which was heated by a mixture of gas and oxygen, with a view to using up the excess of oxygen which the Osram Co. expected to have in connection with their experiments on the half-watt lamp. It indicated one possible use for large quantities of oxygen. He was in entire disagreement with Mr. Brownlie with regard to the use of oxygen. He had had, at different time in his experience, the problem of raising relatively light bodies, small bodies, to a high temperature quickly. He was not at all sure that he would have put as low a limit as 1s. per thousand cu. ft. on the value of even 25 or 30 per cent. oxygen, because, not so much for the increased temperature one could obtain by itself, but in view of the fact that the increased temperature would have reduced materially the time factor in raising those bodies to the temperature which it was necessary they should attain. He believed that in that connection it would be found that air containing 25 or 30 per cent. oxygen would be of very great advantage in many industries. For instance, in certain pottery work, where it was desired to raise the products to a high temperature rapidly and cool down rapidly in order to avoid distortion, he was quite sure that a 25 or 30 per cent. oxygen would be of great value. What he had found so delightful about Mr. Finlayson's paper was not only the scientific and experimental work dealt with, but the fact that the economics of the problem were set out so fully. He hoped that in all papers in the future they would demand to know not only whether the scientific work had led to certain results, but what was the economic bearing of those results on the problem that had been studied.

Dr. R. Lessing said there was one point he would like to mention, because Mr. Brownlie's remarks should not be allowed to go out uncontradicted with the authority of the Institution. He did not see why, in a water gas made with oxygen, even granted that the presence of oxygen would lead to a higher temperature, it should produce a higher percentage of carbon monoxide in gas. At the same rate at which carbon monoxide would be made hydrogen would be made, and therefore all it could do was to reduce the quantity of carbon dioxide, which nobody wanted.

Value of Oxygen for Gas Production

Dr. E. W. Smith said it might be useful to give some general idea as to what the Woodhall-Duckham Co. had in mind when they started this research ; but before doing that he would like to deal with the point raised by Mr. Brownlie as to CO. Did not Mr. Brownlie see that that very trend of being able to utilise complete gasification gas by mixing it with a very rich gas meant that they would be able to use still more completely gasified gas, and that therefore the CO would be still higher than in any gas produced at present ? Personally, he thought it would be a fine thing, because it had not yet been shown that there were less deaths through suicide or through accident in districts like that of the South Metropolitan Gas Co., where they were producing 6 per cent. CO, than there were in districts where they were using up to 25 per cent. water gas, and in which there was, perhaps, 12 per cent. CO.

Mr. Brownlie wanted a reply to the question: "Why do we desire to use oxygen in gas production ?" His company tackled this question solely from the point of view of the production of cheap gas. There were outlets for oxygen of 25 and 30 per cent. purity which would stand a price of 2s. 6d., and even 4s., per thousand cu. ft. One such use in industry was for blowpipe work or for furnace work of a special kind. These uses would stand a very much higher price than 1s. Another outlet that was being considered was in hospitals. If they had the facilities for pumping air containing 25 per cent. oxygen through the wards where chest troubles were being treated it would have an enormous advantage in speeding up recovery. That was an accepted fact and was having consideration at the present moment. If oxygen could be produced at 1s. per thousand cu. ft. down to 30 or 40 per cent. purity, then that type of curative work was going to benefit enormously. This present inquiry, however, was undertaken solely from the point of view of gas production. If a water gas plant could be run continuously not only would it be possible to save the great bulk of the heat which goes away with the blow gases, but there was a bigger gas production, a bigger therm production, and a more highly efficient operation altogether, and the only reply that was effective to Mr. Brownlie was that his own company and Professor Cobb and Mr. Jefferies, of the Jefferies-Norton Co., had calculated that the efficiency of a continuous gasification plant in which the coke was gasified as well as the volatile matter, was as high as 90 per cent. It was felt that by the use of oxygen it would have been possible to erect plants which would be run in such a way that the actual cost per therm, taking into account thermal efficiency, lower capital cost and lower labour cost, would be such as to make it very attractive to the gas industry. Mr. Brownlie was worried about the effect of very high temperatures on ash. He would like to

show Mr. Brownlie producers working with 80 per cent. of ash in the coal or coke and with less than 5 per cent. of carbon in the ashes, and working much more satisfactorily than most producers under ordinary working conditions at the present time. That was one way out. It was possible to liquefy the ash quite nicely and get a producer working at 85 per cent. efficiency over all, including everything, and get a gas of from 130 to 140 B.Th.U. But Mr. Brownlie himself had given the reply; it was not at all necessary to have these high temperatures inside the generator. By the judicious use of steam, which was not a thing which had to be controlled within one or two per cent., the temperatures in the generator could be kept down just as they were in the Mond recovery plant or recovery plant of any kind. They could be kept down well below the danger of fusion of the ash, and the use of oxygen was quite an inocuous thing from that point of view.

Mr. Finlayson's Reply

MR. FINLAYSON, replying to the point raised as to the effect of the addition of soap upon the rate of evolution and not upon the rate of solution, said that perhaps the best thing he could do was to recapitulate what was stated in the paper. Soap had no effect at all upon the rate of solution of gases in water; they dissolved whether the soap was there or not, and the rate of solution was the same. The rate of evolution was speeded up by the presence of soap. In the fractionation process, the thing that mattered was getting the gas off from solution with equilibrium established at each pressure fall, and the establishment of equilibrium at each pressure fall took practically the same time as the rate of evolution. As regards emulsions, he had tried water in oil and oil in water, and the thing was not a success. Then, as regards the question concerning the loss of paraffin oil, he found that the quantity could not be estimated, but it was determined that the gas coming off was not explosive, which was quite important. If there was a slight trace of paraffin, it was not enough to be a serious thing. He did not pretend that he went into the centrifugal process very carefully, because the data which he obtained seemed to show that the power consumption was exorbitant. As to Dr. Goodwin's point regarding the possibility of oil being mixed with the water, due to the washer, he thought he could safely say there was no oil and that it was only water.

MR. L. F. W. LEESE said he thought there would be a large use for air slightly enriched with oxygen in the cement industry. In England, perhaps, the question was not quite so vital, because we have large supplies of good quality slack coal; but on the Continent, he had had to deal with very bad coal indeed. Dealing with coal which would be considered rubbish in this country—20 to 25 per cent. ash—he had found it impossible to keep a rotary kiln sufficiently warm to burn a good cement clinker, but with the addition of 5 per cent. oxygen to the air there was no doubt the temperature could be raised sufficiently to use that quality of coal, and that meant keeping the works running.

Mr. H. Talbot proposed, and Captain Goodwin seconded, a hearty vote of thanks to the author, and at the same time to the Woodhall-Duckham Co., Dr. Smith and Mr. Morgan.

Education of the Chemical Engineer

In the evening an informal dinner was held, after which a short discussion took place upon the education of the chemical engineer.

MR. J. ARTHUR REAVELL (chairman of the Chemical Engineering Group), after expressing the view that the most important thing was a thorough training in fundamental principles, and agreeing with the president that there was a danger of the American chemical engineering student being over-trained, said that he had had one experience of the so-called chemical engineer turned out by a certain university, but he found him perfectly hopeless when put up against a good business problem. It was very necessary that the chemical engineer should be able to produce a balance sheet to show whether a scheme would be commercially sound or not, and he could not help feeling that the whole thing came down to the question of training our professors, most of whom belonged to the older generation and were not chemical engineers at all. There was to be appointed a professor of chemical engineering at the Liverpool University very shortly, and he understood that the Ramsay Chair of Chemical Engineering was shortly to be filled. He hoped that young men would be selected for these posts who had had some practical experience. He agreed with the president that the man who wished to become a chemical engineer should have a good classical training and then build on that his other accomplishments.

Thorough Grounding Necessary

MR. C. S. GARLAND said the first step was to give the student a thorough grounding in the principles of chemistry and engineering, then he should be able to design roughly the plant which was to carry out any particular operation; next, he should be able to see that that plant was worked properly, or, if need be, work the plant himself; and, fourthly, he should be able to see whether the plant would make a profit. His idea of a curriculum was that a boy should remain at school until he was 16 or 17, getting a sound general education, taking his matriculation examination; he should then go for a two years' course on the sandwich system, alternating works practice with college training, after which he should go to a university and take a single course in each of the important sciences; he should then have a year's engineering and a year's chemistry. At the age of 22 or 23 they would then have a man who was soundly trained, and if he went for three or four years as an assistant or a departmental manager in a chemical works, they would, at the end, have a reasonably well-trained chemical engineer on English lines, which were different from American lines. In addition to all this, however, it was most essential that industrialists should come in and help both by providing facilities for the training of students in their works and also sending their works managers and others to lecture at the universities and say what industry wanted. Without that assistance the country could not expect to train chemical engineers. It was a noteworthy fact that in Canada the chemical engineering students obtained posts very much more quickly than the purely chemical students, and he believed the industry in this country for a long time would absorb all the chemical engineering students we could turn out, if they were trained on sound lines.

Industrialists Too Secretive

On the question of students being trained in the works, the president said Mr. Garland's remarks had reminded him of the fact that in America it was a common thing to see a dozen students from a college, under the supervision of an instructor from the college, doing the works testing, and he believed that system would have to come about in this country eventually. At present industrialists were too secretive. The greatest need of this country at the present time was men who could make decisions and who knew how to do things.

MR. DONALD (Imperial College of Science) suggested the formation of a committee to draw up a curriculum, remarking that the subject had been talked about for a very long time.

DR. E. W. SMITH did not believe that any training institution could turn out a chemical engineer. What was required was a thorough training in first principles and a training in how to learn, how to think and how to evaluate facts. Then a man would be able to tackle any subject. A man trained in that way, and with a thorough knowledge of the world, would be able to use the various branches of engineering involved in chemical engineering work without necessarily being expert in all of them himself. The most important point was a fundamental training in the first place.

MR. G. W. RILEY agreed with Dr. Smith that no educational institution could train a chemical engineer. Too much importance was being attached to the engineering side and not enough to the chemical side. There were many excellent engineers to assist the technical chemist on the engineering side, and chemists did not need to be engineers themselves. What was wanted were chemists who were capable of applying what the research chemist had done. Therefore, the first thing that a chemical engineer should become was a real chemist, a man who could appreciate the application of chemistry to industry.

DR. GOODWIN (Canada) said it was simple enough to cater for the exceptional man in chemical engineering, the man who could afford to give the maximum time to his training, but 95 per cent. of students were not exceptional, and could not afford to give more than four or five years to their training. Eighty per cent. of his students took a four years' course at Queen's University, and for the first two years the training

was exactly the same whatever branch of engineering they were to take up eventually. The result of the training given at Queen's University was that his 25 chemical engineering students last year obtained positions two months before they had completed their fourth year.

The President said he hoped the Council would be able to bring a definite scheme before the members at the next annual meeting. He believed the Institution was going to do more for the country than any other institution, inasmuch as the formation of the Institution of Chemical Engineers had in it the germ of a tremendous advance in science. The principal work of the Council during the coming year would be the preparation of a curriculum which it would recommend for the training of the chemical engineer.

Research in Industry

The Development of the Mond Nickel Process

In a recent address given before the Research Conference held in Ottawa, Mr. C. V. Corless, Canadian director and manager of the Mond Nickel Co., Ltd., gave some particulars of the research carried out by the Mond Nickel Co. in Canada, which is the second largest producer of nickel in existence. It operates a number of mines and a reduction plant in the Sudbury District of Canada; refineries in the United Kingdom; a rolling-mill for nickel and one for nickel alloys, together with some other allied plants, in Birmingham; and has an interest in a rolling-mill in Clearfield, Pennsylvania.

All the ores produced in the Sudbury nickel area are sulphides of nickel, copper and iron (known technically as pentlandite, chalcopyrite and pyrrhotite), mixed with varying amounts of rock matter, and containing minute quantities of the precious metals and rare metals of the platinum group.

The company's reduction plant, which is a few miles east of Sudbury, on the Canadian Pacific and Canadian National Railways, consists of a smelter, a sintering plant, and a concentrating mill. The final product of this reduction plant is bessemer matte, containing over 80 per cent. of nickel and copper, 14 or 15 per cent. of sulphur, a varying percentage of oxygen, a few tenths of a per cent. of iron, and small amounts of precious and rare metals, much too small to be expressed significantly in percentages.

This bessemer matte is shipped to the company's refinery at Clydach, in South Wales, an important metallurgical centre. Here the nickel and copper are separated, the former being refined by the carbonyl or Mond process which yields the purest nickel sold (99·8 to 99·9 per cent. nickel) and the latter being sold as copper sulphate, chiefly as an insecticide and fungicide for use in the vineyards of Southern Europe. The residues from this refining process, containing the minute proportions of the precious metals (gold and silver), and of the rare metals of the platinum group (platinum, palladium, ridium, rhodium and ruthenium), are separated and refined at the company's plant in London.

Uses of Nickel

As is well known, nickel finds a very wide market as an alloying metal, chiefly with steel, but also with copper, chromium, manganese, and a number of other metals. Owing to the unique and valuable properties of nickel, it is finding wide uses in the manufacture of containers, utensils, piping, wire, machinery parts, scientific and industrial apparatus, etc., where its peculiar combination of properties—viz., great strength, capacity for receiving and retaining a high polish, great resistance to corrosion, abrasion and oxidation, or other special qualities—are required. It is also used extensively in electroplating, for coinage purposes, and as a catalyst in certain reactions in industrial chemistry, besides having a large number of miscellaneous uses.

The company has spent and is spending large sums of money in studying the physical and chemical properties, in investigating the best methods of manufacture, and in searching out the widest and most suitable fields for use, of nickel and its alloys. Some of these investigations are carried out at the plants in Birmingham and Clearfield already mentioned.

Research Laboratories

It perhaps need hardly be said that each of the plants mentioned has its chemical laboratory. The laboratory is the handmaid of every metallurgical process from the milling and smelting of the ore, through the various steps in further reduction and refining of the metals, and onward into the manufacture of the metal into sheets, bars, wire, tubes, etc., whether these are of pure nickel or of nickel alloys. In investigating these final forms, so as best to adapt the metal or alloy to the particular use for which it is intended, frequent physical tests are applied; for example, tests for electrical resistance, tensile strength, brinell hardness, etc. These tests have to be correlated with both the chemical composition of the metal and the physical and mechanical treatment the metal has received. Half a dozen or more chemical laboratories, with some of the less expensive apparatus for physical testing, are in constant use at every stage between mine and consumer. Some of the larger physical and mechanical tests, which are used less frequently, requiring very costly apparatus, are made, when advisable, in University or other similar laboratories for testing such materials.

Origin of the Carbonyl Process

There is one important aspect of industrial research, well illustrated by the early development of the refining process used by the Mond Nickel Co., which is known as the Mond or carbonyl process for refining nickel. The story of this development is probably familiar to metallurgists.

In Dr. Mond's laboratory in England a scientific discovery was made which formed the starting point of the carbonyl process for refining nickel. A mixture of hydrogen and carbon was being passed over heated, finely divided nickel in order to remove the carbon monoxide. To obviate danger from the poisonous monoxide, the escaping gas was ignited. As the apparatus cooled it was observed that the burning of the escaping gas produced a luminous flame which deposited a film of nickel on cold porcelain, very similar in appearance to the well-known arsenic mirror used as a test for the latter metal. A test showed this deposit to be pure nickel, and further investigation revealed the existence of a hitherto unknown compound of nickel and carbon monoxide, $Ni(CO)_4$, which received the name nickel carbonyl. This compound is formed by passing carbon monoxide over metallic nickel at about 50° C. but is again completely decomposed into nickel and carbon monoxide when heated to 150° C. or higher.

These are scientific facts. As such they merely increased the sum of human knowledge. They were discovered incidentally in the course of research carried on with ultimate industrial aim. But in the fertile brains of Dr. Mond and Dr. Langer these scientific facts proved to be seeds that quickly germinated. But though the germination was quick, full development required much time, faith, courage and will. There followed a period of more than ten years of patient research, invention and construction, during which boundless faith, a faith which was literally "the evidence of things not seen" except in scientific imagination, was the impelling force. Finally an ore body was bought in the Sudbury District, three thousand miles distant, at a time when the future of the district was by no means assured, a mine was developed, a smelter built, in order to test the commercial value of the new process. This was nearly twenty-five years ago. Since then ample ore reserves have been secured, a new and more adequate reduction plant has been built, and the carbonyl process is now annually producing as a refined product thousands of tons of the purest nickel marketed.

It might be difficult to find a better illustration of the great importance of research to any nation whose people have the ambition to rise above the economic status of being "hewers of wood and drawers of water" among the nations of the earth. It is scarcely necessary to add that those responsible for the conduct of a business born of scientific research, developed by scientific research, nurtured by scientific research, and making every step in its progress by scientific research, naturally regard scientific research as the keystone of success in production or in material progress in any direction.

The Scope of Scientific Research

Mr. Corless added a few words in criticism of a tendency to narrow the use of the term scientific research to laboratory dimensions.

The crucial elements of scientific research are: accurate

observation; when necessary, assistance to observation by carefully planned testing or experimenting under known conditions; accurate recording of observed phenomena or facts observed, with correlation of the phenomena or facts observed, with other known facts or laws; if possible, clear interpretation of the observations; and, whenever possible, further testing of the interpretation. The search for new phenomena, new facts, or a new natural law may be among the stars, in the crust of the earth, within a chemical or physical atom, in human society, on a farm or in a garden, in an animate body or one of its organs, in the human brain or the mind itself—it matters not what the field—nor does it even matter what the ultimate motive—provided that the search will stand these tests, it becomes scientific research. This is the most powerful method yet discovered for solving our problems and making intellectual and material progress. It is equally applicable to the discovery of the phenomena and laws of nature, made with no ulterior motive beyond the advancement of knowledge; and to the discovery of the application of these laws in industry, with possibly a somewhat sordid immediate motive, but with the ultimate end in each case that human knowledge is broadened and humanity itself benefited. It is the intelligence and intellectual honesty, rather than the motive, of the investigator, that determines whether or not a given investigation is properly to be classed as scientific research. Probably few scientific specialists engaged in research ever stop to analyse their own motives or to consider how complex these really are. If a research adds to the sum of accurate organised or organisable knowledge, it may, thus far, properly be classed as scientific, even though it may be industrial in its aim. More and more as the domain of science widens is it found that accurate knowledge of almost every description finds a place in the scheme.

The Development of Research

This method of inquiry should be widely inculcated. It should become a national habit of mind. Indeed, the chief intellectual aim of educational institutions should be to fix in the minds of as large a percentage as possible of those passing through them this habit of inquiry, with insignt into the means of satisfying it. The farmer who plants two similar measured plots of ground, one having a single altered condition, the other serving as a control, who keeps an accurate record of the result, and who draws a reliable inference from the experiment, is pursuing scientific research as surely though not as importantly, as is the physicist who, through the liquefaction of helium, achieves the closest approach to absolute zero yet made; or as is the graduate in medicine, working in a pathological laboratory, who discovers new means of diagnosing, preventing or alleviating disease. But the farmer will be greatly assisted if, in addition to an intelligent insight into how to conduct such an inquiry, he has at least such knowledge of elementary science as will assist him to acquaint himself with what has already been accomplished, as well as to eliminate useless experiments. What is really needed in this direction is a change in our national mental attitude. In education having this end in view, it is not so much the quantity of knowledge imparted that counts, as the widespread stimulation of scientific curiosity and love of accurate knowledge, with insight into how to proceed to satisfy this desire.

The general kindling of the spirit of scientific inquiry or research is only one aspect of the national problem. The other centres round the importance of extending, in every way within our national means, those researches carried on, either within or outside of our university and Government laboratories, in larger private laboratories, on experimental farms, in connection with our soil, our forests, our minerals, or our fisheries, or elsewhere. These researches aim to widen the boundaries of knowledge by a study of natural phenomena, or of the laws expressing their relations, or of the best and most efficient means of controlling nature in the interest of man.

This work is generally highly specialised and sometimes costly, though the cost is usually very small relatively to the value of the result achieved. Its national success is conditioned on two factors: adequate financial support and efficient means of selecting and training those gifted with special ability for conducting such investigations. Of even more fundamental importance is it that there should gradually be created, through education in the broadest sense, a wider interest in scientific inquiry, as the most solid and sure foundation of national material prosperity and well-being that can be laid.

Estimation of Tin in Iron and Steel

Methods of Analysis

THE experimental work of Messrs. E. P. Barrett (Assistant Metallurgist, U.S. Bureau of Mines) and J. D. Sullivan (Junior Chemist, U.S. Bureau of Mines) on the utilisation of tin-plate scrap at the North-west experiment station of the U.S. Bureau of Mines in co-operation with the College of Mines, University of Washington, necessitated the selection of a simple method for the determination of tin in the iron produced.

Some of the standard methods for the determination of tin which were tried are given below:—

1. Dissolving in acids and precipitating the tin as sulphide, igniting and weighing as SnO_2.
2. Dissolving in acids, reducing with nickel, cooling in an atmosphere of carbon dioxide, and titrating with standard iodine solution.
3. Dissolving in acids, precipitating the tin as sulphide, dissolving this sulphide in HNO_3 and H_2SO_4, heating until fumes of SO_3 are evolved, reducing with nickel or sheet lead, cooling in an atmosphere of carbon dioxide, and titrating with a standard iodine solution.

Summary of Standard Methods

In the gravimetric determination of tin, weighing as SnO_2 the sample first is digested with HCl until entirely dissolved, the solution filtered and neutralised with NH_4OH, after which sufficient HCl is added to make about 2 per cent. acid solution. The solution is heated to about 80° C., and H_2S is passed in for about an hour, the solution permitted to settle for about half an hour, and H_2S again passed in for about 15 minutes to insure complete precipitation of the tin. The sulphides are removed from solution by filtration, digested with yellow ammonium sulphide to dissolve the tin sulphide, and filtered. The solution so obtained is made acid with acetic acid, precipitating the tin as sulphide, which, after filtration, is dried in a hot-air oven at a very low temperature until absolutely dry, gently heated over a burner, and finally ignited at a high temperature, cooled, and weighed as SnO_2. Care must be used in drying and igniting the precipitated sulphide to prevent loss by volatilisation.

In the method for the volumetric determination of tin in which the reduced tin in solution is titrated with standard iodine solution, the sample is dissolved as in the gravimetric method, filtered, the solution neutralised with NH_4OH, 50 c.c. of HCl added, diluted with water to 200 c.c., a coil of sheet nickel added, and the solution heated until reduction of the tin is complete. (This reduction usually requires about an hour.) Immediately upon removal from the hot plate, small pieces of marble are added to the solution and the neck of the flash covered by a small watch glass to prevent reoxidation of the reduced tin by the oxygen in the air. The solution containing the reduced tin is then cooled in a tray of cold running water. The coil of nickel or lead is removed from the flask, and the cold solution immediately titrated with a standard solution of iodine. A piece of marble should be in the flask at the time of titration.

The third standard method is that of sulphide separation in which the tin is precipitated as sulphide, dissolved, reduced, and titrated with standard iodine solution, by treating the sample with H_2SO_4 until solution is complete, filtered, and after diluting, H_2S is passed into the solution until complete precipitation of the tin as sulphide is obtained. The solution is filtered, and the residue of tin sulphide and the filter paper are placed in a Kjeldahl flask with HNO_3 and H_2SO_4 and heated until fumes of SO_3 are evolved. The solution is then cooled, diluted with water, HCl added, a coiled strip of sheet nickel or lead introduced into the flask, and the mixture is then heated until complete reduction of the tin is obtained. The determination is completed according to directions given in the description of the volumetric determination of tin in which the reduced tin in solution is titrated with standard iodine solution.

Disadvantages of the Standard Methods

The quantity and variety of analytical work in the bureau's laboratory necessitated the adoption of a method requiring only a very small amount of hand manipulation, for this reason the gravimetric method was rejected because it required too many filtrations and other manipulations. The volumetric method was also not suitable partly for the same reasons as the gravimetric, but especially because of the fact that impurities, probably carbon remaining in solution after dissolving the sample in HCl, reacted with the iodine solution and gave high results. The sulphide separation method in which the tin is finally determined by titration with standard iodine solution is used by the U.S. Bureau of Standards, and is the accepted method of the American Association of Official Agricultural Chemists. Although accurate, this method required too much manipulation to be adopted by the laboratory.

The Bureau of Mines Method

The method adopted by the Bureau of Mines is simply a modification of the well-known fusion method for the determination of tin in ores. A sample of 3·0 to 5·0 grams of iron drillings, ground to about 40-mesh, is placed in an iron crucible 2½ in. in diameter, covered with a small amount of Na_2SO_3 and fused in an open flame or in a muffle. Care should be taken to heat slowly, especially when the carbon content is high, to prevent the reaction from taking place with explosive violence and forming globules of metal. There is much less danger of the crucible's burning through when heated slowly. After cooling, the melt is dissolved in water, the solution made acid with HCl, 50 c.c. excess HCl added, the solution transferred to a 700 c.c. Erlenmeyer flask, into which is placed a coiled strip of sheet lead and the solution heated gently until reduction of the tin is complete. After the yellow colour of the ferric chloride has disappeared and the solution is of a bluish colour, the heating should be continued for 1½ to 2 hours to insure complete reduction of the tin. The flask is then removed from the hot plate, pieces of marble added to the solution in order to generate carbon dioxide gas to drive out the air and prevent re-oxidation of the reduced tin by the oxygen from the air. It is advisable to cover the neck of the flash with a small watch glass and to cool rapidly by placing the flask in a tray of cold running water. When cold, more marble is added, the sheet lead removed, and starch solution added. Titration is then made with standard iodine solution. When samples containing only a few hundredths per cent. of tin are analysed, it is necessary to determine a "blank."

Results of the Method

This method has been tried on a great many samples, containing from 0·07 per cent. Sn to 4·5 per cent. Sn, with satisfactory results, and two samples of iron were sent to the U.S. Bureau of Standards for analysis. The results obtained by the Bureau of Standards and by the authors on duplicate samples were in very close agreement, and for practical purposes identical.

The large amount of iron present in each of these determinations greatly increased the length of time of heating necessary to obtain complete reduction, so that when nickel was used to reduce the tin in solution, the solutions became so coloured that satisfactory end points could not be obtained. Strips of Armco sheet iron were used to reduce the tin in solution, and the table given below shows the comparison of results so obtained with those obtained when sheet lead was used to reduce the tin in solution.

COMPARISON OF RESULTS OBTAINED BY REDUCTION OF THE TIN IN SOLUTION BY SHEET LEAD AND BY ARMCO IRON.

Sample No.	Reduction with lead.	Reduction with Armco Iron.
1	4·36 per cent. tin.	4·67 per cent. tin.
2	2·85 " "	3·05 " "
3	1·07 " "	1·25 " "
4	0·84 " "	1·08 " "
5	0·07 " "	0·21 " "

The slightly higher results are probably due to small amounts of carbon in the Armco iron which reacted with the iodine solution upon titration. The use of sheet lead for reducing the tin was then adopted and found to be satisfactory in every respect. It is found that lead chloride precipitates when the reduced solution is cooled, but this does not interfere with the titration nor with the end point.

Advantages and Disadvantages of the Method

The advantages of the method are:—(1) Rapid and complete solution of the sample is assured; (2) all carbon is oxidised and does not interfere; (3) No filtrations or precipitations are required; (4) manipulations are reduced to the minimum. On the other hand, the method cannot be applied to products containing vanadium or chromium because these metals interfere and give high results.

In order to make the standard iodine solution, dissolve 12·7 grams of chemically pure iodine in 200 c.c. of water in which 20 grams of potassium iodide has been dissolved. Make up to 1,000 c.c. If this solution is to be used for very low-grade material it is advisable to dilute one volume of the solution with two volumes of water. The solution is standardised against pure As_2O_3, by weighing 0·2 gram of As_2O_3 into a 250 c.c. Erlenmeyer flask, dissolving in a small volume of a sodium hydroxide solution, heating gently. When all dissolved, dilute to about 100 c.c. with cold water, add a few drops of phenolphthalein indicator and make slightly acid with HCl. Cool in cold running water, add 3 or 4 grams of $NaHCO_3$, 5 c.c. of starch indicator and titrate to a permanent blue colour. A. H. Low recommends that when an acid starch indicator is used, it be added before the $NaHCO_3$. Two-tenths gram As_2O_3 is equivalent to 0·2404 grams of tin.

A Fatal Accident in a Laboratory

Manchester Student Killed

AN inquiry into a fatal accident which occurred recently in a chemical laboratory at the College of Technology, Manchester, was held by Mr. C. W. W. Surridge, the Manchester City Coroner, on Wednesday. The accident, which resulted in the death of John Henry Winchester, aged 20, of Cowesby Street, Moss Side, Manchester, occurred on May 30. Winchester had been a student at the College for about three years.

John Atkinson, another student, said that on the day of the accident he was working in his own laboratory which adjoined the main laboratory where Winchester was working. The deceased was purifying some methyl alcohol which he had in a large flask. Witness heard a noise as though some inflammable material had caught fire and on going to investigate he saw Winchester in flames. He ran for the fire blanket but another student threw his coat round Winchester and the fire was practically out when witness reached him.

Evidence was given by Professor F. L. Pyman, of the Department of Technological Chemistry at the College. Witness stated that Winchester had passed his degree examination and was putting in a year's research work before the conferment of the degree. On the day of the accident Winchester told witness that he proposed doing something for which he required methyl alcohol and asked him if he should dry it. Witness replied that he should. The cause of the fire was the breaking of the flask in which Winchester had the methyl alcohol and the caustic potash used for drying it, although it was impossible to say exactly what was the cause of the breakage. The deceased might have exerted too much pressure on the flask and so stove in the bottom, or he might have been swinging the flask round so as to mix the methyl alcohol and caustic potash and given it a knock against something, though when in hospital Winchester stated that that had not happened. Another possible explanation was that the liquor was super-saturated, in which case gentle agitation would probably suddenly set it in ebullition and cause a lump of the caustic potash to be thrown up and then fall through the bottom of the flask. When the flask broke the contents caught fire from a gas burner. Witness did not think there was any defect either in the flask or in the materials employed. Inflammable liquids were extremely valuable to the chemist, and small fires occurred from them from time to time. The deceased may have been using a large amount of material though not an abnormal quantity. The operation in question was a simple one and one which the student was quite qualified to perform.

Medical evidence was given to the effect that Winchester had died from taxemia and heart failure, the result of burning, and a verdict of "Accidental death" was returned. The coroner said he was satisfied that the flask and the materials were free from any defect, and he did not think the accident was due to any carelessness on the part of Winchester.

Sir George Beilby and Fuel Research

Dr. Lander appointed Successor

THE Lord President of the Council has accepted with much regret the resignation of Sir George Beilby, LL.D., F.R.S., after nearly seven years' voluntary service as Director of Fuel Research and Chairman of the Fuel Research Board under the Department of Scientific and Industrial Research. The Board was established in 1917 to investigate the nature, preparation, and utilisation of fuel of all kinds.

The Lord President has appointed Mr. C. H. Lander, D.Sc., M.I.Mech.E., A.M.Inst.C.E., to be Director of Fuel Research, and Sir Richard Threlfall, K.B.E., F.R.S., a present member of the Board, to be Chairman. The Hon. Sir Charles Parsons, K.C.B., F.R.S., will continue his membership of the Board for a further period. Sir George Beilby retains his membership of the Advisory Council of the Department, and has consented to act as Honorary Adviser to the Board.

The following gentlemen have accepted appointment as additional members of the Board :—Mr. R. A. Burrows, Sir John Cadman, K.C.M.G., D.Sc., Dr. Charles Carpenter, O.B.E., D.Sc., Mr. Samuel Tagg, Professor Sir James Walker, D.Sc., LL.D., F.R.S., and Professor R. V. Wheeler, D.Sc.

Picric Acid Consignment on Fire

Protest at Liverpool

AT the meeting of the Mersey Docks and Harbour Board at Liverpool, on Thursday, June 6, Mr. A. W. Bibby, chairman of the Docks and Quays Committee, related how Liverpool was saved from a catastrophe. On May 30, while a steam crane belonging to the Cunard Steamship Company, Ltd., was being moved at the Alexandra Dock an axle broke, causing the crane to fall over and rest on the top of two railway wagons loaded with picric acid which was being conveyed under military guard for shipment on behalf of the War Department into H.M.S. *Marquis of Hartington*. The fire under the boiler of the crane fell underneath one of the railway wagons, and blazed up to the under side of the wagon floor.

Mr. A. W. Bibby said that the Government had the right to pass through their docks and big populated districts any explosives, however dangerous, and on this occasion they sent 120 tons of picric acid, which was probably one of the most dangerous explosives, right into the centre of their city and docks. The Board had protested and brought the matter before the notice of the authorities, and he hoped a stop would be put to that kind of thing. He understood there were to be further shipments which the authorities proposed making. The stuff was manufactured in Shropshire, and the ordinary course should have been to send it by the quickest possible way to Portsmouth. Instead of that they trained it to Liverpool, and sent it right into a populous district, and commenced dealing with it at the risk of everybody's lives.

Maintenance of Chemical Industry in Germany

GERMANY is more anxious to preserve its chemical industry than any other activity within its boundaries, and intensive efforts to that end are being exerted. The Germans would rather maintain their chemical industry than even the manufacture of iron and steel, despite the success which always has attended their operation of metallurgical plants.

The principal reason for the desire to make the chemical industries Germany's greatest industrial endeavour is the fact that it uses German raw materials almost exclusively. It provides more labour for Germans and presents a field in which the Germans believe they are particularly skilled.

To this end the German chemical manufacturers are demanding relief from export taxes. In addition, they are asking special reductions in the matter of freight rates and coal prices. It is contended that all other industries can afford to contribute something to the effort to restore the chemical industry to its former pre-eminence.

It is known that the Aniline Cartel is only awaiting the agreement on reparations to begin a very active campaign. The cartel is more concerned because of the loss of British and American business than over any other development of the post-war period. Serious consideration is still being given to the establishment of large plants in the United States. Once that the reparation matter is settled, it is believed that Carl von Weinberg will make the long-promised survey of the American situation. Apparently there is a widely-held belief that the interests of the Bädische can be forwarded by the establishment of plants in the United States.

It is known that most of the French dye manufacturers believe their interests would be served best by effecting a close working agreement with the Bädische. There is every reason to believe that the progress already made in that direction will continue.

Chemical Matters in Parliament

Explosives, Liverpool Docks

Mr. Shinwell (House of Commons, June 11) asked the Under-Secretary of State for War whether his attention had been called to the statement made at a meeting of the Mersey Dock and Harbour Board that a large quantity of explosives was sent at the instance of the War Office into Liverpool Docks ; that fire broke out in the trucks containing such explosives ; and that only prompt action on the part of the dock employees averted a terrible disaster ; and had he any statement to make on the matter ?

The Financial Secretary to the War Office (Mr. Gwynne) : My attention has been called to this incident. The explosive was in the docks with the consent of the Mersey Docks and Harbour Board, and was, I understand, being handled with the precautions stipulated for by that Board. The police had been informed, and a military guard was present. Fire did not break out in the trucks containing the explosive, but some live cinders fell near the trucks through an accident to a passing steam crane, for which the War Department had no responsibility. The matter is still under close investigation with a view particularly to seeing whether any additional precautions can be secured in the case of further necessary moves of explosives, but I am advised that in the case now in question there would have been little risk of an explosion even had the fire not been so promptly extinguished as it was.

Mr. Shinwell : Is it the case, as reported in the Press this morning, that in future explosives are to be sent to other ports, particularly Southampton.

Mr. Gwynne : Other consignments may have to be sent to Southampton.

Mr. Shinwell : Are we to understand that proper precautions will be taken to prevent any possibility of further accidents of this kind ?

Mr. Gwynne stated that he had already said that precautions were being taken. In this particular case the accident was one over which neither the War Office nor the Harbour Board had any control.

Thermal Value of Coal

Mr. Hardie (House of Commons, June 12) asked the President of the Board of Trade whether the Committee that was investigating the British thermal value in gas supply had yet reported upon the thermal value of different coals used in the manufacture of gas ?

Sir P. Lloyd-Greame : The hon. member is, I think, under a misapprehension. The Board of Trade Committee which he presumably has in mind was appointed " to inquire and report as to the method of charging for gas on a thermal basis," and their report does not deal with the larger problem to which he refers. That problem is essentially one for the Fuel Research Board established by the Department of Scientific and Industrial Research, and is one of the matters which is under their consideration.

Gretna Factory

Dr. Chapple (House of Commons, June 11) asked the Financial Secretary to the Treasury whether he had received any firm offers for the Gretna factory ; and whether, if offers have been received which are not satisfactory, he would state the price and terms that would be accepted ?

Sir W. Joynson-Hicks said that in regard to the first part of the question he had nothing to add to the answer given by the Chancellor of the Exchequer on February 19 last. It was not considered desirable in the public interest to give the information asked for in the latter part of the question.

From Week to Week

MR. E. A. PINCHIN, B.Sc., has been appointed Public Analyst of the City of London, in succession to Dr. F. L. Teed, who recently resigned.

THE SUDDEN DEATH is announced of Mr. George Black, manager of the Elliot Chemical Works, near Arbroath, N.B. (W. Briggs and Sons, Ltd.).

DR. WILLOUGHBY, the medical officer of the Port of London, has drawn the attention of the Corporation to the large quantities of copper sulphate in the tinned spinach which has been arriving.

Sir ALFRED MOND, M.P., has undertaken to open a discussion on "The legitimate rights and uses of profits," at a week-end conference organised by the Industrial League for June 30 and July 1, at Blunt House, Oxted. The host on this occasion is Sir Ernest Benn.

AN ATTRACTIVE CALENDAR showing a whole month at a time in a long column has been issued by Cochran and Co. (Annan), Ltd., the well-known makers of boilers. The calendar is singularly free from advertising matter, which, though present, is artistically unobtrusive.

ALUMINIUM SULPHATE, which is a by-product of an industry in California which is engaged in making a substitute for fuller's earth from clay, has been found a useful soil corrective for certain plants which require a soil with a slight acid reaction such as aluminium sulphate gives.

WE HAVE RECEIVED a sample of "standard lactose" produced by British Drug Houses, Ltd. This is a new product being tested with six specific biological organisms in accordance with the particulars given on the label, and should meet the requirements of all requiring a specially pure preparation.

THE GENERAL MEDICAL COUNCIL has decided against the proposal to colour strychnine brilliant green. The question of distinguishing certain poisons by means of artificial colouration, they contend, is a general one, which merits consideration in connection with the revision of the pharmacopœia.

A NEW PERIOD of shortage of caustic soda in Germany seems to have set in. The Russians and Austrians appear to be willing to pay more for this commodity than domestic buyers in Germany are willing to pay. In turn the Germans are reluctant to buy abroad in the face of the present currency situation.

ON TUESDAY, when a degree of LL.D. was conferred at Cambridge on the Premier, the degree of Sc.D. was also conferred on the following distinguished foreign scientists: Dr. W. H. Welch (John Hopkins University, U.S.A.), Dr. H. A. Lorentz (Leyden University, Holland), and Dr. Niels Bohr (of "atom" fame).

THE FRENCH GOVERNMENT, which has already passed through the Chamber of Deputies a vote of six million francs (nominally £240,000) for the purpose of supplying agricultural districts with electrical energy, is now being urged to grant a national credit to enable France to develop and make greater use of her water power and thus reduce her bills for imported coal.

THE REPORTS of all the large German dye-stuff makers, comprising the I.G., have now been issued. Considerably increased profits, in paper marks, are shown, and all the companies are paying 300 per cent., as against 30 per cent. last year. The reports mention that the dividend is less than one gold mark (80 gold pfennigs) per 1,000 mark share.

RECENT WORK by the U.S.A. Forest Products Laboratory has established that fermentation of oats will not produce alcohol, although sugar can be obtained in large quantities by hydrolysis of hulls. It is thought that this conclusion confirms the belief that many cellulosic substances which have been considered as possible sources of alcohol are actually not suitable for its production.

THE REPORT of the "Society of Chemical Industry" in Basel points out that the year started under unfavourable circumstances, but that in the second half-year sales reached a more satisfactory level. The difficulties met by the chemical industries are still very great, since many of the old-established markets, especially for dye-stuffs, are totally or partially closed. The English import licence system, intended as a protection for the English dye-stuffs industry, has been more strictly enforced, and in the case of the United States the newly-imposed customs tariff acts as an even stronger deterrent to the importer than the former import restrictions.

SIR WILLIAM BRAGG, in a paper on "Crystal Analysis" published in *Nature* of June 9, states that the applications of the recently discovered knowledge of the structure of crystals by X-ray examination will have important applications in applied science, and he suggests in particular that the knowledge will be useful in determining the crystalline structure of metals, alloys, and clays used in pottery, giving information connected with the strength of such materials.

THE INVESTIGATIONS carried out by the Department of Glass Technology of Sheffield University, published in the Journal of the Society of Glass Technology during 1922 have now been published separately under the title "Experimental Researches and Reports." The matter dealt with includes a review of the British Glass Industry by Dr. W. E. S. Turner, and reports of research carried out to determine the durability of glass and its resistance to chemical reagents.

THE ATTEMPT to prepare certain rare metals being made by the American Department of the Interior at the rare and precious metals station of the Bureau of Mines, will be confined to beryllium for the time being. Sufficient supplies of pure beryllium nitrate for preliminary experiments have been assured. Correspondence has revealed that beryl can be obtained in the United States country in fairly large quantities. Check analyses have been made to confirm the quantities of beryl reported in the ore.

PROFESSOR W. D. BANCROFT, of Cornell University, put forward "A Plea for Research" before the Royal Photographic Society last week. There were, he said, no data for a general theory of photography, and with further research, especially on the chemical side, there was no reason why they should not develop satisfactory pictures with much shorter exposures than now. He referred to experiments that had been made at Cornell with interesting results, and remarked that the plate-make s should undertake experimental work, for anything that enabled things to be photographed that could not be photographed now would be profitable to them.

BEFORE ALDERMAN Sir Charles Johnson at the Mansion House recently, Charles Herbert Spring, 32, a well-dressed man, described as a storekeeper, of Swinton Street, King's Cross, was charged for that, with intent to extort money from Messrs. F. N. Pickett et Fils and to procure an office of profit for himself, he threatened to publish, or proposed to abstain from publishing, certain matters contrary to the Larceny Act, 1916. Accused, it was stated, had been dismissed from the employment of the firm for permission of irregular disposal of "poison gas" under contract for the French Government by pouring it into the sand instead of the receptacles provided. He had then attempted to obtain compensation from the firm. At the close of the hearing, Spring was remanded in custody.

WE UNDERSTAND that in the United States the Detroit Edison Co. have just ordered six water tube boilers, each of 325,000 lb. normal evaporation from and at 212° F. per hour, to be fitted throughout with the "Lopulco" system of pulverised fuel, the European rights of which are controlled by the Underfeed Stoker Co., Ltd., of London. The Detroit Edison Co., as is well known, are one of the largest power users in the world, and this is another striking indication of the remarkable progress that is being made with this system of firing. These new boilers will dispute with the boilers now under construction for the Cleveland Electricity Co., also to be fired with Lopulco pulverised fuel, the distinction of being the largest boilers in the world. In Europe the record is at present held by the 160,000 lb. being constructed for Vitry in France, and in Great Britain the largest unit is 100,000 lb.

AN ORDINARY SCIENTIFIC MEETING of the Chemical Society will be held on Thursday, June 21, 1923, at 8 p.m., when the following papers will be read:—"The constitution of the higher oxide of nickel," by Mr. O. R. Howell. "The relationship of the tautomeric hydrogen theory to the theory of induced alternate polarities," by Messrs. F. Allsop and J. Kenner. "Electron valency theories and stereochemistry," by Mr. S. Sugden. "The relative influences of water vapour and hydrogen upon the combustion of carbon monoxide—air mixtures at high temperatures," by Professor W. A. Bone and Messrs. D. M. Newitt, and D. T. A. Townend. "Metallic hydroxy-acid complexes. Part I. Cuprilactates,"and "Metallic hydroxy-acid complexes. Part II. Cuprimalates, their formation, properties and composition," by Mr. I. W. Wark. "Cholesterol and its rôle in the organism," by Mr. S. Minovici.

References to Current Literature

British

TANNING EXTRACTS.—The manufacture of wood extract. J. A. Reavell. *J.S.C.I.*, June 8, 1923, pp. 245–250T.

ELECTRO-CHEMISTRY.—The production of sulphuric acid and caustic soda by electrolysis of sodium sulphate. E. R. Watson. *J.S.C.I.*, June 8, 1923, pp. 251–252T.

COKE.—A method of making non-fingery coke from bituminous coals high in volatile matter. K. Shimomura. *J.S.C.I.*, June 8, 1923, pp. 556–558.

ORGANO-METALLIC COMPOUNDS.—An electrolytic method for the preparation of mercury dimethyl. J. L. Maynard and H. C. Howard, jun. *Chem. Soc. Trans.*, May, 1923, pp. 960–964.

Organo-derivatives of thallium. Part VI. Compounds of the type R_2TlX. A. E. Goddard. *Chem. Soc. Trans.*, May, 1923, pp. 1161–1172.

DYESTUFFS.—Dyes of the aurin type. Part I. H. Baines and J. E. Driver. *Chem. Soc. Trans.*, May, 1923, pp. 1214–1218.

GASEOUS EXPLOSIONS.—On the propagation of the explosion-wave. Part I. Hydrogen and carbon monoxide mixtures. H. B. Dixon and N. S. Walls. *Chem. Soc. Trans.*, May, 1923, pp. 1,025–1037.

The so-called pre-pressure interval in gaseous explosions. J. D. Morgan. *Chem. Soc. Trans.*, May, 1923, pp. 1,304–1308.

ALKALOIDS.—The morphine group. Part I. A discussion of the constitutional problem. J. M. Gulland and R. Robinson. *Chem. Soc. Trans.*, May, 1923, pp. 980–998.

The morphine group. Part II. Thebainone, thebainol, and dihydrothebainone. J. M. Gulland and R. Robinson. *Chem. Soc. Trans.*, May, 1923, pp. 998–1,011.

DRYING.—Change of properties of substances on drying. Part II. H. B. Baker. *Chem. Soc. Trans.*, May, 1923, pp. 1,223–1,224.

OXIDATION.—Oxidation of nickel sulphide. J. S. Dunn and E. K. Rideal. *Chem. Soc. Trans.*, May, 1923, pp. 1,242–1,251.

The oxidising properties of sulphur dioxide. Part IV. Molybdenum sulphates. W. Wardlaw and N. D. Sylvester. *Chem. Soc. Trans.*, May, 1923, pp. 969–980.

OXIMES.—The isomerism of the oximes. Part XI. Carbethoxy-derivatives. O. L. Brady and G. P. McHugh. *Chem. Soc. Trans.*, May, 1923, pp. 1,190–1,198.

The oxime of mesoxamide (*iso*nitrosomalonamide) and some allied compounds. Part III. Ring formation in the tetra-substituted series. E. H. Usherwood and M. A. Whiteley. *Chem. Soc. Trans.*, May, 1923, pp. 1,069–1,089.

United States

HYDROGEN.—Production of hydrogen by the thermal decomposition of oil. Part I. E. R. Weaver. *Chem. and Met. Eng.*, May 28, 1923, pp. 939–945.

TECHNOLOGY.—Route your materials *via* air line. A short study of the art of pneumatic conveying. F. L. Jorgensen. *Chem. and Met. Eng.*, May 28, 1923, pp. 932–938.

PLANT.—Lead as a material for chemical equipment. G. O. Hiers. *J. Ind. Eng. Chem.*, May, 1923, pp. 467–469.

Enamelled apparatus from a chemical engineering standpoint. E. P. Poste and M. Donauer. *J. Ind. Eng. Chem.*, May, 1923, pp. 469–471.

Acid- and chemical-proof stoneware. M. A. Knight. *J. Ind. Eng. Chem.*, May, 1923, pp. 472–473.

Hard rubber and its application in the chemical industries. A. C. Buttfield. *J. Ind. Eng. Chem.*, May, 1923, pp. 474–475.

GENERAL.—The influence of light on organic matter and life processes. O. Baudisch. *J. Ind. Eng. Chem.*, May, 1923, pp. 451–454.

The influence of modern chemistry on pharmacology. A. D. Hirschfelder. *J. Ind. Eng. Chem.*, May, 1923, pp. 455–460 and p. 524.

French

FUEL.—Liquid fuels. Part X. M. Verneuil. *L'Ind. Chim.*, May, 1923, pp. 201–202.

ACIDS.—The manufacture of sulphuric acid by the contact process. Part XIII. H. Braidy. *L'Ind. Chim.*, May, 1923, pp. 194–196.

PHOTO-CHEMISTRY.—Oxidations and reductions induced by uranium salts under the influence of light. Anti-oxygen action of phenols. Aloy and Valdiguié. *Compt. rend.*, April 30, 1923, pp. 1,229–1,231.

The sensibility of photographic plates made up with mercury salts. G. Athanasiu. *Compt. rend.*, May 14, 1923, pp. 1,389–1,392.

Action of light on emetics. M. Volmar. *Compt. rend.*, May 22, 1923, pp. 1,465–1,467.

PHOSPHATES.—The low-temperature preparation of sodium metaphosphate. P. Pascal. *Compt. rend.*, May 14, 1923, pp. 1,398–1,400.

GLYCERINES.—Tetramethylglycerine. M. Pastureau and H. Bernard. *Compt. rend.*, May 14, 1923, pp. 1,400–1,402.

GASEOUS EXPLOSIONS.—The formation of the explosion wave. P. Laffitte. *Compt. rend.*, May 14, 1923, pp. 1,392–1,395.

MOLYBDATES.—Thorium molybdate $Th(MoO_4)_2$. F. Zambonini. *Compt. rend.*, May 22, 1923, pp. 1,473–1,475.

COLLOIDS.—Purification of liquids by the simultaneous action of centrifugal force and an electric field. A. Marx and J. Rozières. *Compt. rend.*, May 14, 1923, pp. 1,396–1,398.

Kaolins, clays, etc. Colloidal plasticity. A. Bigot. *Compt. rend.*, May 22, 1923, pp. 1,470–1,473.

ANALYSIS.—Estimation of silica in waters. F. Diénert and F. Wandenbulcke. *Compt. rend.*, May 22, 1923, pp. 1,478–1,480.

Estimation of antimony by means of phenylthiohydantoic acid. A. Lassieur. *Compt. rend.*, April 30, 1923, pp. 1,221–1,223.

Phosphoric acid method for the estimation of manganese by titration in the state of permanganic-phosphate. M. Mathevet. *Ann. Chim. Analyt.*, April 15, 1923, pp. 99–108.

OXIDATION.—Formation of pyruvic acid from alanine by direct action of oxygen. L.-J. Simon and L. Piaux. *Compt. rend.*, April 30, 1923, pp. 1,227–1,229.

DEHYDRATION.—Dehydration of gypsum. P. Jolibois and P. Lefebvre. *Compt. rend.*, May 7, 1923, pp. 1317–1320.

Molecular transpositions accompanying the dehydration of phenylethyl αα.-disubstituted primary alcohols. P. Ramart and J. Blondeau. *Compt. rend.*, May 7, 1923, pp. 1,320–1,323.

German

VITAMINS.—Vitamins. C. Brahm. *Z. angew. Chem.*, May 23, 1923, pp. 269–273.

CEMENTS.—Hydraulic cements. Part I. E. Berl and W. Urban. *Z. angew. Chem.*, May 23, 1923, pp. 273–276.

CERAMICS. Stoneware and chemical industry. A. Binz. *Z. angew. Chem.*, May 30, 1923, pp. 285–287.

The physical properties of stonewares. F. Singer. *Z. angew. Chem.*, May 30, 1923, pp. 290–292.

Ceramics in relation to industry and political economy. F. Spitzer. *Z. angew. Chem.*, May 30, 1923, pp. 287–290.

PIGMENTS.—Lithophone; the mechanism of the reaction of the blackening by light of zinc sulphide. E. Maass and R. Kempf. *Z. angew. Chem.*, June 6, 1923, pp. 293–297.

METHANE.—The partial combustion of methane. E. Berl and H. Fischer. *Z. angew Chem.*, June 6, 1923, pp. 297–302.

BLEACHING.—The reaction underlying the bleaching of vegetable fibres with hypochlorite. C. G. Schwalbe and H. Wenzl. *Z. angew. Chem.*, June 6, 1923, pp. 302–304.

ELECTRO-CHEMISTRY.—Electrolytic zinc. M. v. Schwarz. *Z. Elektrochem.*, May, 1923, pp. 198–207.

Electrolysis in liquid sulphur dioxide. M. Centerszwer and J. Drucker. *Z. Elektrochem.*, May, 1923, pp. 210–214.

REDUCTION.—The reduction with hydrogen of metal oxides reducible with difficulty. H. v. Wartenberg, J. Broy and R. Reinicke. *Z. Elektrochem.*, May, 1923, pp. 214–217.

Patent Literature

Abstracts of Complete Specifications

197,198. CAUSTIC SODA, MANUFACTURE OF. Courtaulds, Ltd., 19, Aldermanbury, London, and R. O. Jones, 161, Tulse Hill, London. Application date, May 16, 1922.

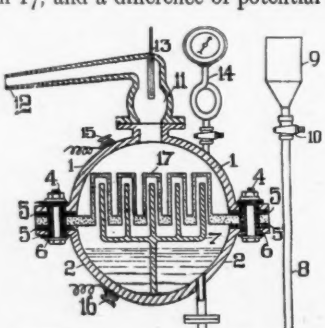
In the manufacture of caustic soda from sodium carbonate and lime, it is usual to use dilute solutions, not above 8 per cent., to avoid the reversal of the reaction, and to concentrate the resulting solution of caustic soda by evaporation. In the present invention, caustic soda solution up to 24 per cent. strength can be obtained without evaporation, and nearly free from sodium carbonate. A 27 per cent. solution of sodium carbonate is causticised as completely as possible with lime, yielding a 15 per cent. solution of caustic soda and a 7·1 per cent. solution of sodium carbonate. The liquor is cooled to −15° C., when the sodium carbonate separates out as the decahydrate, leaving only about 0·8 per cent. in solution. The caustic soda is then about 18·3 per cent. strength. A stronger solution of caustic soda may be obtained by starting with a solution containing 19–20 per cent. caustic soda and 5–6 per cent. sodium carbonate, obtained as described in Specification 182,661 (see THE CHEMICAL AGE, Vol. VII, p. 213), and cooling this to −15° C. The resulting solution contains about 23 per cent. of caustic soda and 1 per cent. of sodium carbonate. These solutions are suitable for mecerising cotton, treating cellulose to produce viscose, or making soap.

197,199. CATALYSTS MORE PARTICULARLY FOR THE SYNTHESIS OF AMMONIA. L. Casale, 9, Via del Parlamento, Rome. Application date, May 16, 1922.

An iron catalyst, particularly suitable for ammonia synthesis, is obtained by bringing iron or an iron alloy into violent ebullition by means of oxygen under pressure. It is found that if about 5–15 per cent. of the oxidation product formed thereby is allowed to vaporise, the impurities detrimental to catalysis are removed with the vapour. The presence of alkaline earth oxides or metalloids, which may be associated with the iron, facilitates the operation. The product may be crushed and then used, or it may be reduced in hydrogen or nitrogen-hydrogen mixture. This catalyst is also suitable for oxidising carbon monoxide or ammonia, or for producing hydrogen from steam and carbon monoxide.

197,353. FRACTIONAL SEPARATION OF VAPOURS AND GASES, PROCESS AND APPARATUS FOR. Plauson's (Parent Co.), Ltd., 17, Waterloo Place, London, S.W.1. From H. Plauson, 14, Huxter, Hamburg, Germany. Application date, December 7, 1921.

A mixture of gases or vapours is separated into its constituents by passing it through a porous diaphragm having a different electrical potential from that of the vapour. Two hemispherical members 1, 2 are separated by a diaphragm 17 of porous material, and are held together by insulated bolts 4. A forked electrode 7 projects into the recesses of the diaphragm 17, and a difference of potential is maintained



197,353

between the terminals 15, 16. The material to be separated is supplied through the pipe 8, and the vapour which passes through the diaphragm is drawn off through the pipe 12. The diaphragm may be composed of sand, glass powder, carbon, graphite, carborundum, metals, china clay, silicic acid, cement, chalk, gypsum, felspar, etc., supported on a porous partition, or it may be rigid. The mixture is evaporated in the vessel 2, and vapour of the same polarity as the diaphragm passes through, but vapour of opposite polarity is retained. The vapour may be further subjected to the action of a second diaphragm of the same or different polarity. In some cases, such as the distillation of oils containing wax, paraffin, naphthalene, anthracene, etc., the impurities may stop up the diaphragm, and to prevent this, a knife, worm, or other scraping device may be provided. In large scale operations, a horizontal porous cylinder, which is slowly rotated, may be used. The apparatus may be used for treating substances such as an emulsion of crude petroleum and water to obtain a clear anhydrous petroleum, or for separating substances of the same boiling point, *e.g.*, an alcohol and a hydrocarbon, or for fractional distillations.

197,357. CONCENTRATION OR IMPROVEMENT OF SOLID FUELS. T. Rigby, 72, Victoria Street, London, S.W.1. Application date, January 4, 1922.

The object is to concentrate fuel such as low-grade coal. The material is crushed and then separated by froth flotation and the portion of low ash content is used for coke production. The low grade material is dried in a current of hot gas, and used directly as a combustible in powdered fuel burners.

197,372. LIGHT HYDROCARBON DISTILLATES. D. W. Hovey, Shreveport, Louisiana, U.S.A. Application date, February 6, 1922.

Crude oil, or heavy distillate, is distributed from a pipe in the upper part of a still which is maintained at a considerable pressure, and is heated internally to 800°–1,000° F. by means of superheated steam. The oil is agitated by injecting steam into it. It is found that the highest proportion of gasoline is obtained at a pressure of 50–75 lb. per sq. in., while at higher pressures, unsaturated gases are also produced.

197,389. REFINING PETROLEUM. P. T. Sharples, Merion, Pa., U.S.A. Application date, February 9, 1922.

The object is to simplify the process of distilling petroleum to increase the yield of lubricating oils. Crude petroleum is distilled to drive off the more volatile constituents, but not the light lubricating oils, and without cracking the residue. The residue is diluted with naphtha, chilled to precipitate the wax, and passed through a centrifugal separator to remove wax. The lubricating residue is then steam distilled to remove the naphtha and spindle oil in succession, leaving the lubricating oil. The cracking distillation of the heavy lubricating oils, and separate apparatus for removing crystalline wax and amorphous wax, are avoided by this process.

197,429. PURIFICATION OF FATS AND OILS AND THE TREATMENT OF DUST-LIKE SUBSTANCES WITH SOLVENTS. H. Bollmann, 1, Alsterdamm, Hamburg, Germany. Application date, February 17, 1922.

The apparatus is for decolorising fats and oils by means of bleaching earths, or extracting fine substances from oil sediments. The material to be treated and the active material are conveyed in steps in opposite directions through superposed chambers in a tower. Each chamber is provided with a non-return valve so that while one material is settling in one chamber, the other material is passing upwards into the next chamber. In the next step, the first material passes downwards to the next chamber, and so on.

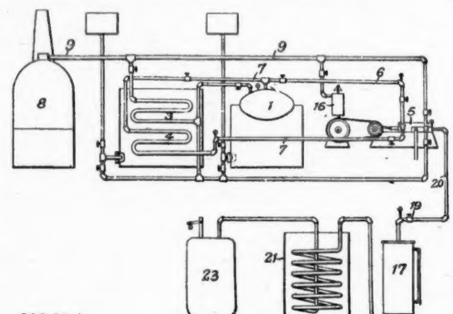
197,433. ORE OR FUEL BRIQUETTES AND APPARATUS FOR MAKING. Andrews and Co., Ltd., Blackfriars House, New Bridge Street, London, E.C.4; and Sir A. M. Duckham, 52, Grosvenor Gardens, London, S.W.1. Application date, February 18, 1922.

Ore or fuel briquettes are made by mixing the subdivided material with waste sulphite liquor, and then briquetting. The briquettes are immersed in a bath of molten lead at a temperature of about 450° C. for about five minutes, which renders them water-resistant and structurally strong. The briquettes may be caused to travel through the hot space above the molten metal to dry them, and are then forced through the molten metal.

(*Continued on page* 653.)

197,494-5. CRACKING HYDROCARBONS, PROCESS AND APPARATUS FOR. S. L. Garthan, 273, Poplar Plains Road, Toronto; and A. E. Gooderham, 4, Lamport Avenue, Toronto, Canada. Application date, April 4, 1922.

Mineral hydrocarbons are converted into products of lower boiling point by vaporising them at a temperature and pressure which do not change the molecular structure, then subjecting them to high pressure, and then suddenly expanding them. A steam generator 8 is connected by a pipe 9 to an engine 16, to a superheater 3, and to the outer jacket 5 of a compressor. The compressor is connected by a pipe 20 to the expansion vessel 17 through a reduction valve 19, and the vessel 17 to a



197,494

cooler 21 and receiver 23. The vaporiser 1 is connected by valved pipes 6, 7, to the compressor 5, and to the superheater 4, the opposite end of which is connected by a pipe 7 to the compressor 5. In treating Texas fuel oil, the vaporiser 1 is maintained below 400° C., and the compressor 5 about 550° C. When vapour begins to be evolved, the compressor is started, and the vapour drawn through the superheater and compressed suddenly to a pressure up to 1,500 lb. per sq. in. The vapour is then suddenly expanded in the vessel 17 to atmospheric pressure, and is dissociated into compounds of lower boiling point.

197,573. ZIRCONIUM ALLOYS AND PROCESS OF MAKING. E. C. R. Marks, London. From Electro-Metallurgical Co. 30 East 42nd Street, New York. Application date, June 22, 1922.

When zirconia is reduced in an electric furnace, contamination of the product with carbon may be prevented by adding silica. An iron-zirconium-silicon alloy may thus be prepared, which does not contain sufficient carbon to interfere with the electric furnace operation in its manufacture, or with its subsequent use in the treatment of steel. The silicon is added in quantity sufficient to form an alloy containing at least as much silicon as zirconium, and the melting point of the alloy is thus reduced and its solubility in steel increased. Several examples of such alloys are given.

197,576. CRACKING OILS, PROCESS OF AND APPARATUS FOR. A. J. Mahan, Rutland, Vermont, and T. J. Lynch, Holyoke, Mass., U.S.A. Application date, June 26, 1922.

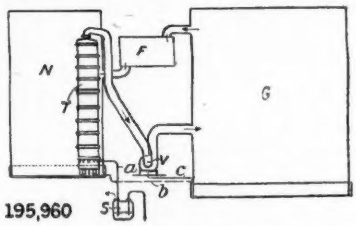
Kerosene is passed at a pressure slightly above atmospheric, through a preheating coil and then into a cracking coil in which the temperature is raised to 1,275°–1,500° F. at the same pressure. The cracked products, which resemble gasolene are then condensed.

NOTE.—Abstracts of the following specifications which are now accepted appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 173,225 (Barrett Co.), relating to the manufacture of resin, see Vol. VI., p. 287; 183,419 (National Aniline and Chemical Manufacturing Co. Inc.), relating to the production of vat dye, see Vol. VII., p. 424.

International Specifications not yet Accepted

195,960. SULPHURIC ACID. Verein für Chemische und Metallurgische Produktion, Aussig, Czecho-Slovakia. International Convention date, April 10, 1922.

The object is to obtain pure sulphuric acid by the lead chamber process, by purifying the gases. The gases are drawn from a lead chamber G through a filter F to an auxiliary chamber N, and then into the bottom of an incorrodible tower T containing glass rings, in which the acid is condensed. This acid is pure and is drawn off through a pipe *a* to a glass vessel S. The purified gases in the chamber N are returned



195,960

to the chamber G by a fan V, and acid is returned from the chamber N to the chamber G by a pipe *c*. The water required for the reaction in the chamber G is purified or admitted as steam.

196,237. LIQUID FUEL. General Motors Research Corporation, Dayton, Ohio, U.S.A. Assignees of T. Midgley, 813, Ferndale Avenue, Dayton, Ohio, U.S.A. International Convention date, April 15, 1922.

To increase the critical compression value in internal combustion engine cylinders, the fuel is mixed with a small proportion of alkyl or phenyl compounds of lead, such as tetraethyl lead, the methyl, isopropyl and triethyl hydroxide compounds of lead, lead acetate or oleate, and the alkyl and phenyl compounds of selenium, tellurium, tin, arsenic, antimony, etc.

196,258. HYDROCHLORIC ACID. Verein für Chemische und Metallurgische Produktion, Aussig, Czecho-Slovakia. International Convention date, April 13, 1922.

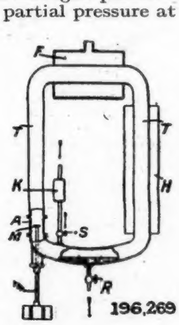
Hydrochloric acid obtained in the manufacture of chlorinated organic substances is passed over decolourizing charcoal to purify it.

196,265. SYNTHETIC RESINS. Holzverkohlungs-Industrie Akt.-Ges., Konstanz, Baden, Germany. International Convention date, April 11, 1922.

Aromatic hydroxy compounds such as phenols or naphthols, are treated with methylene chloride in the presence of two or more molecules of ammonia for each molecule of methylene chloride, with or without other bases such as sodium hydroxide. In an example, a yellow resin is obtained by heating phenol, methylene chloride, and aqueous ammonia to 150° C.

196,269. NITROGEN OXIDES. L'Air Liquide, Soc. Anon, pour l'Etude et l'Exploitation des Procédés G. Claude, 48, Rue St. Lazare, Paris. (Assignees of G. Claude, 48, Rue St. Lazare, Paris). International Convention date, April 15, 1922.

A mixture of nitrogen and oxygen is heated in an electric arc at a pressure of 100–200 atmospheres, so that the actual partial pressure of the nitrogen peroxide is above 0·25 atmospheres, which is the partial pressure at the liquefying point



196,269

at atmospheric pressure. The gas is then cooled under the same pressure to −10° to −12° C. to liquefy the nitrogen peroxide. A rotary electrode M is arranged in a closed tube T in a part A which is water-cooled, and the nitrogen-oxygen mixture is delivered through a valve S. Coolers F, H are provided, and liquid nitrogen peroxide collects at the bottom and is drawn off at R.

196,272. HALOGEN HYDROCARBONS. Farbwerke vorm. Meister, Lucius and Brüning, Hoechst-on-Main, Germany. International Convention date, April 15, 1922.

Halogen substituted hydrocarbons are passed, together with water, over a catalyst at a temperature up to 400° C. to convert them into other products having a higher number of carbon atoms. Metals such as platinum may be employed as catalysts, or compounds such as thorium oxide, zirconium chloride, bismuth oxide, stannons chloride or zinc chloride. In an example, methyl chloride and some water are passed over finely divided platinum heated to 275° C., yielding ethyl chloride, unchanged methyl chloride and hydrochloric acid. The acid is absorbed in water, and the chlorides are separated by absorption in active charcoal, or by liquefaction and fractional distillation. If a mixture of methyl chloride and methylene chloride is passed over bismuth chloride on active charcoal heated to 280° C., ethylidene chloride and methylal are obtained. If methyl chloride is passed over bismuth oxide on charcoal heated to 240° C., ethylene is obtained.

LATEST NOTIFICATIONS

198,645. Processes of manufacturing sulphate of chromium. Nydegger, Dr. O. May 31, 1922.

198,661. Apparatus for the distillation of solid or liquid substances. Dupuy, H. May 30, 1922.

198,676. Manufacture of highly-chlorinated hydro-aromatic products containing nitrogen. Durand and Huguenin Akt.-Ges. May 31, 1922.

Specifications Accepted, with Date of Application

176,794. Paints, Manufacture of. P. O. Abbé, Inc. March 8, 1921

184,787. Gases, Purification of, by tooling. L'Air, Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude. August 13, 1921.

189,450. Menthol, Process for the production of inactive. Rheinische Kampfer-Fabrik Ges. November 23, 1921.

195,352. Separation of the constituents of air. L'Air Liquide Soc. Anon. pour l'Etude, etc., l'Exploitation des Procédés G. Claude. March 23, 1922.

197,971. Activated carbon from peat, lignite, sawdust or other carbonaceous material, Manufacture of. Count L. le W. Hamon and T. H. Byrom. November 18, 1921.

197,974. Refining of oils. G. J. Lemmens. November 22, 1921.

197,978. Securing intimate contact of liquids and gases, Apparatus for. J. E. L. Barnes (*Colorado Iron Works Co.*). November 23, 1921.

197,987. Ferro-chrome, Refining of. W. R. Saltrick. December 29, 1921.

198,009. Starch conversion products. A. E. Alexander (*Stein-Hall Manufacturing Co.*). February 14, 1922.

198,023. Artificial silk and like threads, Processes and apparatus for manufacturing. British Cellulose and Chemical Manufacturing Co., Ltd., C. W. Palmer and W. Whitehead. February 18, 1922.

198,024. Electrolysing fused salts of metals, Process and apparatus for. E. A. Ashcroft. February 18, 1922.

198,049. Inks, paints, varnishes, dyes and the like, Manufacture of. J. W. Spensley, and Chemical Engineering Co. (Manchester) Ltd. February 23, 1922.

198,071. Cracking mineral oil to produce gasoline, Apparatus for. B. van Steenbergh. February 27, 1922.

198,077. Vat dyestuffs of the anthraquinone series, Manufacture of. R. B. Ransford (*L. Casella and Co.*). February 27, 1922.

198,242. Fertilisers and processes for the production thereof. G. W. S. Brewer. July 3, 1922.

198,246. Anodes for forming percompounds. Chemische Fabrik Weissenstein Ges., and G. Baum. July 7, 1922.

198,250. Distilling apparatus. H. Bollmann. July 11, 1922.

Applications for Patents

Babcock and Wilcox, Ltd., and Babcock and Wilcox Co. Water-tube boilers. 14,907. June 7.

Bloxam, A. G., and Chemische Fabrik Griesheim-Elektron. Manufacture of acylacetyl compounds. 14672. June 4.

Bloxam, A. G., and Durand et Huguenin Soc. Anon. Manufacture of chlorinated amines. 14671. June 4.

Cross, C. F. Manufacture of cellulose products. 14772. June 5.

Imray, O. Y., and Soc. of Chemical Industry in Basle. Manufacture of naphthioindoxyls. 14945. June 7.

Imray, O. Y. Manufacture of indigo dyestuffs, etc. 15071. June 8.

Reinau, E. Fertilising with carbonic acid. 14729. June 5. (Germany, June 21, 1922.)

Rhenania Verein Chemischer Fabriken Akt.-Ges. Production of salts of barium and strontium soluble in water. 14663. June 4. (Germany, July 31, 1922.)

Still, C (Firm of). Methods of extracting hydrocarbons from coal gas, etc. 14754. June 5.

British Chemical Trade

Independent of Foreign Supplies

A CORRESPONDENT in *The Bulletin*, published by the Federation of British Industries, states that business in chemicals during the past month has been comparatively quiet, but may be considered satisfactory in view of the general conditions of trade. The export demand has been well maintained, and in this connection it is interesting to notice the statistics published by the Board of Trade for the month of April. The conditions in Germany are still in favour of the British manufacturer, but there is not much doubt that in the course of time she will develop her chemical factories outside the occupied area. It is satisfactory to know, however, that with a few exceptions, such as potash products, Great Britain is now independent of foreign sources of supply of essential chemical products. The reduced railway rates in operation from May 1 have resulted in the lowering in price of the delivered products of several heavy chemicals by the makers.

Heavy Chemicals

Among the heavier chemicals salt cake has been in very good demand for export and supplies are none too plentiful. Lithopone has been particularly affected by the Continental conditions, and in the course of a few weeks increased in price from £18 10s. to £23 per ton. Acetic acid and wood distillation products generally have been some of the best features during the month. Acetates are all very firm markets, grey acetate of lime having advanced to £22, while brown sugar of lead is considerably higher at £45 per ton. Wood tar has also advanced to £6 per ton. Retort charcoal and wood naphtha, both miscible and solvent, have also been scarce.

All grades of boric acid have been reduced by the British makers by £5 per ton, and borax prices have also been reduced.

The reduced output of ammonium sulphate by the gas companies, natural to the summer months, has been more than compensated for by the increased activity of the coke ovens. All through the winter there has been a scarcity of this product throughout the world, but it is probable that a reserve will be built up during the coming months. Attention has been directed to the subject of synthetic ammonia by Mr. Kilburn Scott's Cantor Lectures at the Society of Arts. It is interesting to hear that Brunner, Mond and Company, Limited, have been producing several tons of synthetic ammonia daily at their new works, and it is expected that before the end of the year the production will be at the rate of 150,000 tons of sulphate of ammonia per annum.

Superphosphate Fertilisers

The demand for superphosphate fertilisers for the season now ending will no doubt show a considerable falling off, owing to the depression in agriculture. Trade in Scotland has been good, the Scottish farmers, although frugal by habit, realising that it pays to spend money on fertilisers. In the North of England the demand has been fair and a little below normal, while in the southern counties trade has been from 25 per cent. to 40 per cent. below the average. The manufacturers in this country have met with very keen competition from Belgium and Holland, and although most of the plants are still working, the future is problematical.

The market for tar products has been much quieter during the last month, with naphthalene as the best feature. Practically no business in pitch has been done for the current season, and prices are nominal. Contracts for autumn delivery have been made on the basis of about 140s. per ton. Disinfectants, however, have lately been a good market, and insecticides have been inquired for by the agricultural community.

As was to be expected in view of the stoppage of supplies from Germany, pharmaceutical chemicals have been very firm and a number of advances in price have been recorded. Quotations from the Continent are in most cases well above spot prices. Actual business, however, has not been very brisk, although lately some improvement has been noticed. In particular benzoates and bromides have improved in value. Barbitone has been quoted up to 20s. per lb., and phenolphthalein at 5s. 6d. is in short supply, and large quantities are unobtainable even at this figure. Potassium permanganate has been active throughout the month and the forward position is very firm. In fact the general tendency of the fine chemical section is towards still higher prices.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to* THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

London, June 14, 1923.

THE market has been quiet this week, and is without special feature. With few exceptions prices are very firm. There is considerable inquiry for export destinations, but business is slow in maturing.

General Chemicals

ACETONE is in good demand; price unchanged.

ACID ACETIC passes steadily into consumption, and the market is particularly firm.

ACID CITRIC is slow, due, it would appear, to climatic conditions.

ACID FORMIC is scarce on the spot, and the value is well maintained.

ACID OXALIC is a slow market, and the price is easier on realisation account.

ACID TARTARIC is slightly weaker, due to the disappointing season.

ARSENIC is not so firm, although makers show great reluctance in reducing prices.

BARIUM CHLORIDE is inactive.

CREAM OF TARTAR is a fair market, and spot supplies are scarce.

FORMALDEHYDE is in very short supply, and high prices are realised for spot goods.

LEAD ACETATE is a fair market, and the price is below the parity of the raw materials.

METHYL ALCOHOL is unchanged.

CAUSTIC POTASH.—The demand is nominal.

POTASH CARBONATE is unchanged.

POTASH PERMANGANATE is a steady market at recent levels.

POTASH PRUSSIATE is lower in price; the demand is slow.

SODA ACETATE is very active, with makers well sold over the remainder of the year.

SODA BICHROMATE.—Foreign competition seems to have been eliminated for the time being. The English makers have the market in their own hands.

SODA HYPOSULPHITE is without special feature.

SODA NITRITE.—There is practically no demand.

SODA PRUSSIATE is again weaker in price, but the market is thought to have touched bottom.

SODA SULPHIDE.—Unchanged.

ZINC OXIDE.—Unchanged.

Pharmaceutical Chemicals

ACETYL SALICYLIC ACID continues in fair demand, and prices are maintained.

BROMIDES.—The position is unchanged, cheap offers due to the German exchange still being made. Makers' prices are maintained.

CHLORAL HYDRATE.—No change.

EUCALYPTUS OIL.—The demand is still small, but prices have a firmer tendency.

GUAIACOL CARBONATE.—Little inquiry. Prices must increase when second-hand stocks are cleared.

MILK SUGAR.—Makers' quotations are maintained, but second-hand parcels of doubtful quality are on offer.

PHENACETIN.—In fair demand at prices quoted.

PHENOLPHTHALEIN.—Firm, small stocks only being available.

SALICYLIC ACID still remains in good demand, and prices are maintained.

SODA BENZOATE is much firmer in sympathy with the advance in benzoic acid.

SALOL.—Makers are asking higher prices, but there is a good deal available in second hands.

VANILLIN finds a ready market at price quoted.

Coal Tar Intermediates

There is no particular change to report in this market during the past week.

ALPHA NAPHTHOL continues in demand, with practically no spot stuff available.

ALPHA NAPHTHYLAMINE.—More trade is reported and export inquiries have been received.

ANILINE OIL is unchanged.

BENZIDINE BASE.—Home buyers are interested.

BETANAPHTHOL has attracted more attention than of late.

DIMETHYLANILINE is a small home business.

DINITROCHLORBENZOL.—Foreign buyers are interested.

NAPHTHIONIC ACID.—A moderate trade is reported.

NITROBENZOL is easier.

PARANITRANILINE is a small home business.

"R" ACID.—Some inquiry is in the market

Coal Tar Products

The tone of the market in coal tar products is quieter, and prices in general have a downward tendency.

90% BENZOL is fairly firm at 1s. 7d. per gallon on rails.

PURE BENZOL is in poor demand, and is worth about 2s. 1d. per gallon on rails in the north and 2s. 4d. to 2s. 5d. per gallon in the south.

CREOSOTE OIL is quietly firm at 8d. to 8¼d. per gallon in the north and 8¾d. to 9d. per gallon in the south.

CRESYLIC ACID has only a very moderate inquiry, and is worth 2s. 1d. per gallon on rails for the pale quality, 97/99%; while the dark quality, 95/97%, is 1s. 10d. per gallon.

SOLVENT NAPHTHA is unchanged at 1s. 4d. per gallon.

HEAVY NAPHTHA is steady at 1s. 6d. per gallon.

NAPHTHALENES have little fresh demand, the cheaper qualities remaining steady at about £7 per ton, while the better qualities are quoted at from £10 to £11 per ton.

PITCH.—The market remains in an unsettled condition. Buyers are still inactive, and business is very restricted.

Sulphate of Ammonia

The market is steady.

[*Current Market Prices on following pages.*]

Lithopone Manufacture in France

THE manufacture in France of lithopone is now being increased with the object of avoiding the need for its importation—part of the broad scheme now being considerably fostered by the French Government, and all the manufacturers, for rendering France less dependent upon foreign products, and, as an immediate consequence, the improvement of the value of the franc. Lithopone is, of course, the product used to substitute oxide of zinc and white lead, the use of both these substances in France having been prohibited by law in January, 1922. The discontinuance, in fact, of the use of the two bodies is becoming general in Europe. In 1916 France was importing 747 tons of lithopone, and in 1920 the quantity had risen to 8,955 tons, and two or three firms commenced the manufacture of it, especially those firms who had facilities for the raw materials necessary, baryta and salts of zinc. The substance is less expensive than white lead or oxide of zinc, is much more easy to manipulate and mix, and presents fewer inconveniences in application than the bodies it has substituted. It is not harmful to those who make it up or those who use it. It enters into the manufacture of numerous paints, varnishes, lacquers, linoleums, oilcloths, wallpapers, printing inks, and rubber goods. Although it was an English invention, fifty years ago, it was first manufactured for industrial purposes in Germany, where it was made for many years before firms in Spain and the United States took it up. The latter country manufactured 57,000 tons in 1919, 100,000 tons in 1920, and last year 140,000 tons. France only aims at manufacturing enough for home requirements.

Current Market Prices

General Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride, 90–95%	lb.	0	1	4	to	0	1	5
Acetone oil	ton	90	0	0	to	95	0	0
Acetone, pure	ton	121	0	0	to	125	0	0
Acid, Acetic, glacial, 99–100%	ton	69	0	0	to	70	0	0
Acetic, 80% pure	ton	50	0	0	to	51	0	0
Acetic, 40% pure	ton	25	0	0	to	26	0	0
Arsenic, liquid, 2000 s.g.	ton	88	0	0	to	90	0	0
Boric, commercial	ton	50	0	0	to	55	0	0
Carbolic, cryst. 39–40%	lb.	0	1	8	to	0	1	9
Citric	lb.	0	1	10	to	0	1	10½
Formic, 80%	ton	50	0	0	to	51	0	0
Hydrofluoric	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.	ton	41	0	0	to	43	0	0
Lactic, 60 vol.	ton	43	0	0	to	44	0	0
Nitric, 80 Tw.	ton	27	0	0	to	28	0	0
Oxalic	lb.	0	0	6½	to	0	0	6¾
Phosphoric, 1.5	ton	35	0	0	to	38	0	0
Pyrogallic, cryst.	lb.	0	5	9	to	0	6	0
Salicylic, Technical	lb.	0	1	9	to	0	2	0
Sulphuric, 92–93%	ton	6	0	0	to	7	0	0
Tannic, commercial	lb.	0	2	3	to	0	2	9
Tartaric	lb.	0	1	5	to	0	1	5½
Alum, lump	ton	12	10	0	to	13	0	0
Chrome	ton	28	0	0	to	29	0	0
Alumino ferric	ton	7	0	0	to	7	5	0
Aluminium, sulphate, 14–15%	ton	8	10	0	to	9	0	0
Sulphate, 17–18%	ton	10	10	0	to	11	0	0
Ammonia, anhydrous	lb.	0	1	6	to	0	1	8
.880	ton	32	0	0	to	34	0	0
.920	ton	22	0	0	to	24	0	0
Carbonate	lb.	0	0	4	to	0	0	4½
Chloride	ton	50	0	0	to	55	0	0
Muriate (galvanisers)	ton	35	0	0	to	37	10	0
Nitrate (pure)	ton	35	0	0	to	40	0	0
Phosphate	ton	68	0	0	to	70	0	0
Sulphocyanide, commercial 90%	lb.	0	1	1	to	0	1	3
Amyl acetate	ton	175	0	0	to	185	0	0
Arsenic, white powdered	ton	73	0	0	to	75	0	0
Barium, carbonate, Witherite	ton	5	0	0	to	6	0	0
Carbonate, Precip.	ton	15	0	0	to	16	0	0
Chlorate	ton	65	0	0	to	70	0	0
Chloride	ton	16	0	0	to	16	10	0
Nitrate	ton	33	0	0	to	35	0	0
Sulphate, blanc fixe, dry	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%	lb.	0	0	11	to	0	1	0
Bleaching powder, 35–37%	ton	10	10	0	to	11	0	0
Borax crystals	ton	27	0	0	to	—		
Calcium acetate, Brown	ton	11	10	0	to	12	0	0
Grey	ton	19	15	0	to	20	0	0
Carbide	ton	16	0	0	to	17	0	0
Chloride	ton	5	15	0	to	6	0	0
Carbon bisulphide	ton	35	0	0	to	40	0	0
Casein technical	ton	100	0	0	to	105	0	0
Cerium oxalate	lb.	0	3	0	to	0	3	6
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	6	0	to	0	6	6
Oxide, black	lb.	0	9	6	to	0	10	0
Copper chloride	lb.	0	1	1	to	0	1	2
Sulphate	ton	27	0	0	to	28	0	0
Cream Tartar, 98–100%	ton	97	10	0	to	100	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	92	10	0	to	95	0	0
Formusol (Rongalite)	lb.	0	2	1	to	0	2	2
Glauber salts, commercial	ton	5	0	0	to	5	10	0
Glycerin crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal	0	2	2	to	0	2	3
Iron perchloride	ton	28	0	0	to	30	0	0
Sulphate (Copperas)	ton	3	10	0	to	4	0	0
Lead acetate, white	ton	43	0	0	to	45	0	0
Carbonate (White Lead)	ton	45	0	0	to	48	0	0
Nitrate	ton	44	10	0	to	45	0	0
Litharge	ton	39	0	0	to	40	0	0
Lithophone, 30%	ton	22	10	0	to	23	0	0
Magnesium chloride	ton	4	7	6	to	4	10	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	6	10	0	to	7	0	0
Sulphate (Druggists')	ton	10	0	0	to	11	0	0
Manganese Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	50	0	0	to	55	0	0
Methyl acetone	ton	78	0	0	to	80	0	0
Alcohol, 1% acetone	ton	105	0	0	to	110	0	0
Nickel sulphate, single salt	ton	39	0	0	to	40	0	0
Ammonium sulphate, double salt	ton	39	0	0	to	40	0	0
Potash, Caustic	ton	35	0	0	to	36	0	0
Potassium bichromate	lb.	0	0	5¾	to	0	0	6
Carbonate, 90%	ton	31	0	0	to	32	0	0
Chloride, 80%	ton	9	0	0	to	10	0	0
Chlorate	lb.	0	0	4	to	0	0	4½
Metabisulphite, 50–52%	ton	75	0	0	to	80	0	0
Nitrate, refined	ton	43	0	0	to	45	0	0
Permanganate	lb.	0	0	10½	to	0	0	11
Prussiate, red	lb.	0	3	3	to	0	3	6
Prussiate, yellow	lb.	0	1	4½	to	0	1	5
Sulphate, 90%	ton	10	10	0	to	11	0	0
Salammoniac, firsts	cwt.	3	3	0	to	—		
Seconds	cwt.	3	0	0	to	—		
Sodium acetate	ton	25	0	0	to	25	10	0
Arsenate, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	4½	to	0	0	4¾
Bisulphite, 60–62%	ton	21	0	0	to	23	0	0
Chlorate	lb.	0	0	3¼	to	0	0	3½
Caustic, 70%	ton	19	10	0	to	20	0	0
Caustic, 76%	ton	20	10	0	to	21	0	0
Hydrosulphite, powder	lb.	0	1	5	to	0	1	6
Hyposulphite, commercial	ton	10	10	0	to	11	0	0
Nitrite, 96–98%	ton	27	10	0	to	28	0	0
Phosphate, crystal	ton	16	0	0	to	16	10	0
Perborate	lb.	0	1	0	to	0	1	1
Prussiate	lb.	0	0	7¾	to	0	0	8
Sulphide, crystals	ton	10	10	0	to	11	0	0
Sulphide, solid, 60–62%	ton	16	10	0	to	17	10	0
Sulphite, cryst.	ton	12	10	0	to	13	0	0
Strontium carbonate	ton	50	0	0	to	55	0	0
Nitrate	ton	50	0	0	to	55	0	0
Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Flowers	ton	11	10	0	to	12	10	0
Roll	ton	11	0	0	to	12	0	0
Tartar emetic	lb.	0	1	2	to	0	1	3
Tin perchloride, 33%	lb.	0	1	1	to	0	1	2
Perchloride, solid	lb.	0	1	3	to	0	1	4
Protochloride (tin crystals)	lb.	0	1	4	to	0	1	5
Zinc chloride 102° Tw.	ton	20	0	0	to	21	0	0
Chloride, solid, 96–98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	50	0	0	to	52	0	0
Dust, 90%	ton	50	0	0	to	55	0	0
Sulphate	ton	16	0	0	to	17	0	0

Pharmaceutical Chemicals

	Per	£	s.	d.		£	s.	d.
Acetyl salicylic acid	lb.	0	3	3	to	0	3	6
Acetanilid	lb.	0	1	6	to	0	1	9
Acid, Gallic, pure	lb.	0	3	0	to	0	3	3
Lactic, 1.21	lb.	0	2	3	to	0	2	9
Salicylic, B.P.	lb.	0	2	2	to	0	2	6
Tannic, leviss.	lb.	0	3	2	to	0	3	4
Amidol	lb.	0	7	9	to	0	8	3
Amidopyrin	lb.	0	13	0	to	0	13	3
Ammon ichthosulphonate	lb	0	1	11	to	0	2	2
Barbitone	lb.	1	1	0	to	1	3	0
Beta naphthol resublimed	lb	0	1	9	to	0	2	0
Bromide of ammonia	lb.	0	0	8	to	0	0	9
Potash	lb.	0	0	7	to	0	0	8
Soda	lb.	0	0	7½	to	0	0	8½
Caffeine, pure	lb.	0	11	0	to	0	11	6
Calcium glycerophosphate	lb.	0	5	9	to	0	6	0
Lactate	lb.	0	2	0	to	0	2	3
Calomel	lb.	0	4	9	to	0	5	0
Chloral hydrate	lb.	0	3	10½	to	0	4	0
Cocaine alkaloid	oz.	0	18	0	to	0	18	6
Hydrochloride	oz.	0	14	9	to	0	15	0
Corrosive sublimate	lb.	0	4	3	to	0	4	6
Eucalyptus oil, B.P. (70–75% eucalyptol)	lb.	0	1	7	to	0	1	8
B.P. (75–80% eucalyptol)	lb.	0	1	8	to	0	1	9
Guaiacol carbonate	lb.	0	8	6	to	0	8	9
Liquid	lb.	0	9	6	to	0	10	0
Pure crystals	lb.	0	10	3	to	0	10	6
Hexamine	lb.	0	4	0	to	0	4	3
Hydroquinone	lb.	0	3	6	to	0	3	9
Lanoline anhydrous	lb.	0	0	7	to	0	0	7½
Lecithin ex ovo	lb.	0	17	6	to	0	19	0
Lithi carbonate	lb.	0	9	6	to	0	10	0
Methyl salicylate	lb.	0	2	5	to	0	2	8
Metol	lb.	0	10	6	to	0	11	6
Milk sugar	cwt.	4	10	0	to	4	12	6
Paraldehyde	lb.	0	1	6	to	0	1	9
Phenacetin	lb.	0	6	6	to	0	7	0
Phenazone	lb.	0	7	9	to	0	8	0
Phenolphthalein	lb.	0	6	6	to	0	6	9
Potassium sulpho guaiacolate	lb.	0	5	0	to	0	5	3
Quinine sulphate, B.P.	oz.	0	2	3		—		

	Per	£	s.	d.		£	s.	d.
Resorcine, medicinal	lb.	0	5	6	to	0	5	9
Salicylate of soda powder	lb.	0	2	6	to	0	2	9
Crystals	lb.	0	2	9	to	0	3	0
Salol	lb.	0	2	9	to	0	3	0
Soda Benzoate	lb.	0	2	5	to	0	2	7
Sulphonal	lb.	0	14	6	to	0	15	0
Terpene hydrate	lb.	0	1	9	to	0	2	0
Theobromine, pure	lb.	0	10	6	to	0	11	0
Soda salicylate	lb.	0	7	9	to	0	8	3
Vanillin	lb.	1	3	0	to	1	4	0

Coal Tar Intermediates, &c.

	Per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	2	0	to	0	2	3
Refined	lb.	0	2	6	to	0	2	9
Alphanaphthylamine	lb.	0	1	6	to	0	1	7
Aniline oil, drums extra	lb.	0	0	9	to	0	0	9½
Salts	lb.	0	0	9½	to	0	0	10
Anthracene, 40–50%	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	3	0	to	0	3	3
Benzidine, base	lb.	0	4	9	to	0	5	0
Sulphate	lb.	0	3	9	to	0	4	0
Benzoic acid	lb.	0	2	0	to	0	2	3
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol	lb.	0	1	1	to	0	1	2
Betanaphthylamine, technical	lb.	0	4	0	to	0	4	3
Croceine Acid, 100% basis	lb.	0	3	3	to	0	3	6
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	4	6	to	0	4	9
Dinitrobenzol	lb.	0	1	1	to	0	1	2
Dinitrochlorbenzol	lb.	0	0	11	to	0	1	0
Dinitronaphthalene	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	4	to	0	1	5
Dinitrophenol	lb.	0	1	6	to	0	1	7
Dimethylaniline	lb.	0	3	0	to	0	3	3
Diphenylamine	lb.	0	3	6	to	0	3	9
H-Acid	lb.	0	5	0	to	0	5	3
Metaphenylenediamine	lb.	0	4	0	to	0	4	3
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	5	9	to	0	6	0
Metatoluylenediamine	lb.	0	4	0	to	0	4	3
Monosulphonic Acid (2.7)	lb.	0	7	6	to	0	8	6
Naphthionic acid, crude	lb.	0	2	3	to	0	2	6
Naphthionate of Soda	lb.	0	2	6	to	0	2	9
Naphthylamin-di-sulphonic-acid	lb.	0	4	0	to	0	4	3
Nevill Winther Acid	lb.	0	7	3	to	0	7	9
Nitrobenzol	lb.	0	0	7	to	0	0	8
Nitronaphthalene	lb.	0	0	11½	to	0	1	0
Nitrotoluol	lb.	0	0	8	to	0	0	9
Orthoamidophenol base	lb.	0	12	0	to	0	12	6
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	0	10	to	0	0	11
Orthonitrotoluol	lb.	0	0	3	to	0	0	4
Para-amidophenol, base	lb.	0	8	6	to	0	9	0
Hydrochlor	lb.	0	7	6	to	0	8	0
Paradichlorbenzol	lb.	0	0	6	to	0	0	7
Paranitraniline	lb.	0	2	7	to	0	2	9
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	2	9	to	0	3	0
Paraphenylenediamine, distilled	lb.	0	12	0	to	0	12	6
Paratoluidine	lb.	0	5	9	to	0	6	3
Phthalic anhydride	lb.	0	2	6	to	0	2	9
Resorcin, technical	lb.	0	4	0	to	0	4	3
Sulphanilic acid, crude	lb.	0	0	10	to	0	0	11
Tolidine, base	lb.	0	7	3	to	0	7	9
Mixture	lb.	0	2	6	to	0	2	9

Essential Oils and Synthetics

Essential Oils.

		£	s.	d.
Anise	c.i.f. 1/10 spot	0	2	0
Bay		0	12	0
Bergamot		0	12	0
Cajaput		0	3	9
Camphor, white	per cwt.	4	0	0
Brown	"	3	15	0
Cassia....dearer and very scarce. No c.i.f. offers;	spot	0	10	6
Cedarwood	easier	0	1	4½
Citronella (Ceylon)	very scarce	0	3	6
(Java)		0	4	0
Clove	easier	0	6	9
Eucalyptus	firm and scarce	0	1	8
Geranium Bourbon		1	10	0
Lavender		0	12	6
Lavender spike		0	3	0
Lemon	easier	0	3	0
Lemongrass	per oz.	0	0	2¼
Lime (distilled)	firm	0	4	0
Orange sweet (Sicilian)	easier	0	13	6
(West Indian)		0	10	6
Palmarosa	scarce	0	19	0
Peppermint (American)		0	13	0
Mint (dementholised Japanese)	harder	0	6	9
Patchouli		1	12	0
Otto of Rose	harder, per oz.	1	4	0
Rosemary		0	1	8
Sandalwood		1	6	0
Sassafras	dearer	0	5	3
Thyme	2/6 to	0	8	0

Synthetics.

		£	s.	d.
Benzyl acetate		0	3	0
Benzoate		0	3	0
Citral		0	10	0
Coumarine		0	17	0
Heliotropine		0	7	6
Ionone		1	5	0
Linalyl acetate		1	2	6
Methyl salicylate		0	2	6
Musk xylol	dearer	0	10	6
Terpeniol		0	3	1

The Colnbrook Chemical Co.

Mr. Justice Astbury, in the Chancery Division on Wednesday, June 6, decided in favour of the Attorney-General, on behalf of the Crown, in an action by him against the Colnbrook Chemical Co. for disclosure in respect of a mortgage security dated M y 6, 1916, given by the company in favour of the Minister of Munitions. The company was created for the purpose of manufacturing chemicals and explosives, and was incorporated in 1913. The Minister of Munitions lent from time to time sums amounting in all to upwards of £20,000. In their defence to the action, the company said the Minister appointed a receiver under the powers in his mortgage and also purported to take possession of the company's factory and certain assets under the powers contained in the Defence of the Realm Act. He must be deemed, they said, to have taken possession under the powers in his mortgage as mortgagee, and they were entitled to have included in the redemption account full accounts in connection with the Minister's possession. His Lordship said the company was in liquidation and was probably wholly unable to redeem in whatever way or manner the amount fixed for redemption was arrived at. It would be necessary to decide whether the Minister took possession of the company's factory and its materials under the Defence of the Realm Act or under the mortgage, and if in the former case whether he was liable to account in this action generally and not in respect only of the receipts and expenditure of the receiver appointed under the mortgage. The Attorney-General held that the Minister took possession under D.O.R.A. and as mortgagee. There would be the usual foreclosure order, and the accounts under the order would be limited to the principal moneys and interest and payments and receipts by the receiver, including an occupation rent of the property taken by him. The judgment, said his Lordship, would be without prejudice to any claim that might be validly brought before the War Losses Commission by the company.

Dyestuffs (Import Regulation) Act

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during May has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 497, of which 409 were from merchants and dealers. To these should be added the 17 cases outstanding on May 1, making a total for the month of 514. These were dealt with as follows:—

Granted, 304 (of which 293 were dealt with within seven days of receipt).

Referred to British makers of similar products, 136 (of which 130 were dealt with within seven days of receipt).

Referred to Reparation Supplies available, 53 (all dealt with within two days of receipt).

Outstanding on May 31, 21.

Of the total number (514) of applications received, 458, or 89 per cent., were dealt with within four days of receipt.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, June 13, 1923.

DURING the past week business has been, if anything, a little better, a moderate number of inquiries being received, mostly for export.

Continental offers continue plentiful, and in most cases are lower than a week ago.

Industrial Chemicals

ACID, ACETIC.—Glacial, 98/100%, £61 to £70 per ton; 80% pure, £49 to £50 per ton; 80% technical, £47 to £48 per ton, c.i.f. U.K. ports, duty free.

ACID, BORACIC.—Prices unchanged. Crystal or granulated, £50 per ton; powdered, £52 per ton, carriage paid U.K. stations.

ACID, CARBOLIC.—Ice crystals now on offer at 1s. 5d. per lb.

ACID, CITRIC.—Quoted about 1s. 8d. per lb., ex store.

ACID, FORMIC, 80%.—Price about £50 to £51 per ton.

ACID, HYDROCHLORIC.—Unchanged at 6s. 6d. per carboy, ex works.

ACID, NITRIC 84°.—£27 10s. per ton, ex station, full truck loads.

ACID, OXALIC.—About 6¼d. per lb. In little demand.

ACID, SULPHURIC.—144°, £3 15s. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality 20s. per ton more.

ALUM, LUMP POTASH.—Offered from Continent at £9 per ton, c.i.f. U.K. Spot lots about £12 per ton, ex store.

AMMONIA, ANHYDROUS.—Inclined to be easier at about 1s. 5½d. per lb., ex station.

AMMONIA, CARBONATE.—Lump, 4d. per lb.; ground, 4½d. per lb., delivered.

AMMONIA, LIQUID 880°.—About 3½d. per lb., packages extra.

AMMONIA, MURIATE.—Galvanizers, grey quality, about £32 per ton f.o.r.; fine white crystals, £25 per ton, ex wharf, early delivery.

ARSENIC, WHITE POWDERED.—In moderate demand. Now quoted £76 per ton, ex quay.

BARIUM CHLORIDE, 98/100%.—Large crystals about £13 5s. per ton; powdered, £12 12s. 6d. per ton, c.i.f. U.K.

BARYTES.—Fine white English unchanged at £5 5s. per ton, ex works.

BLEACHING POWDER.—£11 7s. 6d. per ton, ex station, spot delivery. Contracts 20s. per ton less.

BORAX.—Manufacturers advise reduction in prices of 20s. to 30s. per ton. Crystal, £27 per ton; powder, £28 per ton; granulated, £26 10s. per ton, delivered U.K. stations.

CALCIUM CHLORIDE.—English make, £5 12s. 6d. per ton, ex quay or station. Continental material about £4 5s. per ton, c.i.f. U.K.

COPPER SULPHATE.—Cheap parcels on offer at £24 per ton, f.o.b. U.K.

COPPERAS, GREEN.—Offered at £2 5s. per ton, f.o.b. U.K.

FORMALDEHYDE 40%.—Spot lots about £91 per ton, quoted £86 per ton, ex wharf, early delivery.

GLAUBER SALTS.—In little demand. Prices about £3 15s. per ton, ex store.

LEAD, RED.—English material, £41 per ton, carriage paid U.K. Continental about £37 per ton, ex store.

LEAD ACETATE.—White crystals, £41 10s. per ton, ex wharf, early delivery.

MAGNESIUM CHLORIDE.—Spot lots about £3 per ton. Offered from Continent at £1 17s. 6d. per ton, c.i.f. U.K.

MAGNESIUM SULPHATE (EPSOM SALTS).—Commercial crystals, £7 per ton; B.P. Crystals, about £8 5s. per ton; Continental commercial crystals, about £4 per ton, ex store.

POTASH, CAUSTIC, 88/92%.—Quoted £29 per ton, c.i.f. U.K. Spot lots about £32 per ton, ex store.

POTASSIUM BICHROMATE.—Unchanged at 5⅝d. per lb., delivered.

POTASSIUM CARBONATE, 96/98%.—£33 per ton; 90/92%, £27 10s. per ton, ex wharf, early delivery.

POTASSIUM CHLORATE.—Crystals or powdered, 3d. per lb., ex store.

POTASSIUM NITRATE (SALTPETRE).—Nominally £32 per ton, ex store.

POTASSIUM PERMANGANATE.—B.P. quality about 10¾d. per lb., ex store.

POTASSIUM PRUSSIATE (YELLOW).—Now offered at 1s. 4½d., ex wharf, early delivery.

SODA, CAUSTIC.—76/77%, £21 7s. 6d. per ton; 70/72%, £19 17s. 6d. per ton; 60/62%, broken, £21 2s. 6d. per ton; 98/99%, powdered, £24 15s. per ton, all ex station, spot delivery.

SODIUM ACETATE.—Now quoted £25 10s. per ton, ex wharf, early delivery.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay. M. W. quality, 30s. per ton less.

SODIUM BICHROMATE.—Unchanged at 4½d. per lb. delivered.

SODIUM CARBONATE.—Soda Crystals, £5 to £5 5s. per ton, ex quay or station. Alkali, 58%, £8 16s. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—Commercial crystals offered at £8 5s. per ton, c.i.f. U.K. Spot lots about £9 15s. per ton, ex wharf. Pea crystals quoted £15 10s. per ton, ex store.

SODIUM NITRATE.—Refined 96/98% quality, £13 7s. 6d. per ton, f.o.r. or f.o.b. U.K.

SODIUM PRUSSIATE (Yellow).—Now offered at 7d. per lb. c.i.f. U.K.

SODIUM SULPHATE (Saltcake 95%).—£4 per ton, ex station, for home consumption. Higher prices for export.

SULPHUR, Flowers, £10 per ton; Roll, £9 per ton; Rock, £9 per ton; Ground, £8 per ton; prices nominal.

TIN CRYSTALS.—Unchanged at 1s. 4d. per lb.

ZINC SULPHATE.—Commercial crystals offered at £11 per ton, ex store.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

DINITROBENZENE.—Good export inquiry. Price, 1s. 3d. per lb. f.o.b. U.K. port.

DINITROTOLUENE.—Export inqury. Price 1s. 3½d. per lb. f.o.b. U.K. port.

GAMMA ACID.—Export inquiry. Price quoted, 12s. 7d. per lb. 100% basis, f.o.b.

METAPHENYLENEDIAMINE.—In good demand from abroad. Price quoted, 5s. 2d. per lb. 100% basis, f.o.b.

NAPHTHIONATE OF SODA.—Home inquiry. Price, 2s. 8½d. per lb. 100% basis.

NAPHTHIONIC ACID.—Good home demand. Price 2s. 6d. per lb. 100% basis, carriage paid.

NEVILLE AND WINTHER ACID.—Export inqury. Price 6s. per lb. 100% basis, f.o.b.

NITRONAPHTHALINE, REFINED.—Home inqury. Price, 1s. per lb. delivered.

S.S. ACID.—Home inquiry. Price quoted, 16s. 6d. per lb. 100% basis.

SULPHANILIC ACID.—Export inquiry. Price, 1s. 1½d. per lb. 100% basis, f.o.b.

A New Steam Boiler

THERE is at present being erected at a works at Rugby a boiler which will work at the enormous pressure of 3,200 lb. per sq. in. Since the latent heat of steam diminishes with increased pressure and becomes zero at the pressure named (the "critical" pressure), an engine working under these conditions should be more efficient, owing to the removal of latent heat losses. The industrial application of such high pressures will be watched with interest by chemists and chemical engineers.

"A Flood of Replies"

A CORRESPONDENT, whose announcement recently appeared in THE CHEMICAL AGE, writes:—

"I have had quite a flood of inquiries as the result of the publicity you gave my letter, and I am grateful to you."

Manchester Chemical Market

(FROM OUR OWN CORRESPONDENT.)

Manchester, June 14, 1923.

ALTHOUGH the general tone of the chemical market here remains quiet there is a fairly steady business being put through, both on home and foreign account, in certain lines, and more particularly in the case of alkali, bleaching powder, and caustic soda. No further easing of prices from the levels of last week is to be reported. Steadiness rules in practically every case and, in some instances, additional firmness due to restricted supplies is to be observed.

Heavy Chemicals

Caustic soda is still in steady request from home users, and prices are firmly maintained at from £19 for 60 per cent. to £21 10s. per ton for 76-77 per cent. material; for export also good business is being done. Bleaching powder is in active demand for both branches of trade, and price to home users is unchanged at £11 7s. 6d. per ton. Soda crystals are quiet but steady at £5 5s. per ton delivered. Saltcake is being steadily called for, particularly for shipment, and quotations are firm at £4 10s. per ton. Sodium sulphide is rather inactive at £14 10s. per ton for 60-65 per cent. concentrated solid and £8 10s. to £9 per ton for crystals. Glauber salts also are a rather dull section, with prices steady at £4 per ton. Bicarbonate of soda is firm and in fair inquiry at £10 10s. per ton delivered to home users. The demand for alkali for home consumption and for export keeps up, and prices for the former are steady at about £7 12s. 6d. per ton for 58 per cent. material. Hyposulphite of soda is quiet, though no alteration in prices can be reported; photographic crystals are on offer at £15 per ton, and commercial at £10 10s. Nitrite of soda is very firm at £27 per ton, supplies still being on the short side. Phosphate of soda is steady, though inactive at round £14 10s. per ton. Chlorate of soda is firm and in moderate inquiry at 2¾d. per lb. Prussiate of soda is quiet and prices, though weak, have been maintained at last week's level of 7¼d. per lb. Bichromate of soda is in fair demand at 4½ per lb. Acetate of soda is rather firmer at £25 per ton.

Caustic potash is well held at £32 to £33 per ton for 88-90 per cent. material, supplies being readily taken up. Carbonate of potash is in steady demand, and prices are maintained at £32 per ton 96-98 per cent. and £29 for 90-92 per cent. Bichromate of potash is steady and in fair inquiry at 5⅜d. per lb. Yellow prussiate of potash is still inactive, but prices are unchanged at round 1s. 3¾d. per lb. Chlorate of potash is in moderate inquiry at 2¾d. to 3d. per lb. Permanganate of potash is firm at 9⅝d. per lb., a steady demand being met with.

Sulphate of copper is said to be in better inquiry for shipment at £25 10s. to £26 10s. per ton, f.o.b. Arsenic keeps scarce and firm at round £75 per ton for white powdered, Cornish makes, cheaper rates being quoted for foreign brands. Commercial Epsom salts, British makes, are in moderate demand at £5 10s. to £6 per ton; magnesium sulphate, B.P., is about unchanged at £7. On continued scarcity acetate of lime keeps firm at £22 for grey and £12 per ton for brown. Nitrate of lead is also very firm at £43 per ton. Supplies of sugar of lead are not excessive, and prices are maintained at £43 per ton for white and £42 to £43 for brown.

Acids and Tar Products

Tartaric acid is steady at 1s. 3½d. per lb., and meets with a fairly good demand. Citric acid, B.P. crystals, are quieter, and prices are a shade easier at 1s. 8d. per lb. Acetic acid is firm and in good inquiry at round £70 for glacial and £48 per ton for 80 per cent. technical. Oxalic acid is still a dull section at 6¼d. per lb.

The demand for pitch has fallen off considerably, and prices are lower, between £5 10s. and £6 per ton, f.o.b. Manchester, being the current quotation. Carbolic acid crystals are quiet but steady at 1s. 5d. per lb., crude, 60 per cent., being unchanged at about 3s. 6d. per gallon. Benzol is inactive at 1s. 7d. per gallon. Solvent naphtha is rather easier at 1s. 6d. per gallon and meets with a subdued demand. Creosote oil is more active and somewhat firmer at 9d. per gallon. Naphthalenes are fairly steady at £20 for flake and £7 to £14 per ton for crude.

The Confederation Life Association

IN the 51st annual report of the Confederation Life Association it is stated that during the year applications for new insurances were received amounting to £5,556,886. The assets at December 31 last were £6,888,418, showing an increase of no less than £639,872 for the year. The rate of interest earned, computed on the basis of net ledger assets, the Dominion Government basis of calculation as set forth under the Canadian Insurance Act, was £6 3s. 10d. per cent. This exceeds the company's valuation rate—3 per cent.—used in computing the reserve under participating policies issued since 1900, which constitute nearly 85 per cent. of the Association's total business, by over 3 per cent.

It has been said that the company which can show the largest margin of interest earned over that assumed is the company which—other factors being equal—will produce the best results to its policyholders. The position of this Association in this respect is exceptionally good, and the prospects from this point of view could hardly be excelled. The Association values its reserves upon an even firmer basis than that set forth by the Canadian Insurance Act, the reserves held by the company exceeding the stringent Government standard by over £145,890. The investments of the Association have, as usual, received the most careful attention. It will be noted that the report reveals a profit on the sale of securities of £6,890. The policy of the directors is to select the strongest securities available, and to distribute the investments over wide ground.

The mortality experience of the company continues to be of the most favourable nature, and during the past year was only 52 per cent. of the expected. It will also be noted that, taking into account the entire period of the Association's history, the income from interest and rents has exceeded the death claims by £1,155,676. The total amount paid and held on policyholders' account during the same period was £15,412,243—the net premium income (including annuity premiums) being £14,553,253—showing that for each £100 received the company has paid or holds for the benefit of policyholders and annuitants £105 18s.

The surplus earned during the year amounted to £215,257, a large increase on the previous year. The total undivided surplus as at December 31 last was £686,977. Under the terms of the company's charter, holders of participating policies are entitled to share in profits to the extent of not less than 90 per cent. of the profits arising from the participating class, and since the year 1887 the amount so apportioned has actually averaged 96 per cent. per year. During the last five years the whole amount, or 100 per cent., was actually transferred to the credit of the policyholders' account.

The Association introduced at the beginning of this year an improved "Total and Permanent Disability Benefit" under which it is now possible to secure life assurance, disability insurance, and accident insurance—a permanent feature of the policy. If the insured becomes totally disabled, he receives a guaranteed monthly income, and his premiums are paid for him. He may be disabled for months or years, but the income continues to be paid. Life assurance is also now transacted without medical examination, at all ages from 18 to 45.

Recent Wills

Mr. George Ward, F.I.C., F.C.S., of Victoria Road, Headingley, Leeds, chemist, of the firm of Messrs. Hurst, Brooke and Hurst £2,359

Mr. Gustav Adolf Boeddicker, of St. Mary's Road, Harborne, Birmingham, analytical chemist £23,624

Evershed and Vignoles Limited

IT will be remembered that the first chairman of the company was the late Professor W. E. Ayrton, F.R.S., who held the position till within a few months of his death in 1908. Since that date the chairmanship has remained vacant. Mr. SYDNEY EVERSHED, who has recently retired from the position of managing director, has now accepted the office of chairman, and will in addition act as consultant to the company. Mr. E. B. Vignoles and Mr. A. Vines remain managing directors of the company.

Company News

NOBEL INDUSTRIES, LTD.—The transfer books for the ordinary shares will be closed from to-day, June 16 to June 30, both days inclusive.

BRYANT AND MAY, LTD.—The transfer books of the 4 per cent. and 5 per cent. debenture stocks will be closed from June 17 to 30, inclusive.

PINCHIN, JOHNSON AND CO., LTD.—The transfer books of the preference shares will be closed from June 18 to June 30 (inclusive) for the preparation of dividend warrants.

ALLEN-LIVERSIDGE, LTD.—The directors have declared an interim dividend for six months at the rate of 10 per cent. per annum. The interim dividend a year ago was at the rate of 7 per cent.

SULPHIDE CORPORATION.—Interim dividends are announced at the rate of 10 per cent. on the preference shares and the ordinary shares, in respect of the year to June 30, payable on July 12. The transfer books will be closed from June 18 to June 29, both days inclusive.

THE ASSOCIATED PORTLAND CEMENT MANUFACTURERS, LTD.—The transfer books and register of members of the company's first mortgage 4½ per cent. debenture stock were closed yesterday. June 15, and will remain closed until July 1, for the preparation of the half-yearly interest warrants.

UNITED PREMIER OIL AND CAKE CO., LTD.—The registers and transfer books of the 6 per cent. debenture stock and the 7 per cent. cumulative preference shares will be closed from June 18 to June 30, both days inclusive, for the preparation of the warrants for the interest and dividend for the half year ending June 30, 1923.

TEHIDY MINERALS, LTD.—The report for the year 1922 states that the profit was £3,750, compared with a loss of £9,966 for 1921. After deducting the debit brought in of £2,589, a credit balance of £1,161, subject to corporation profits tax (if any), is carried forward. Meeting, East Pool Mine, Carn Brea, Cornwall, on June 23, at 12.30 p.m.

UNITED INDIGO AND CHEMICAL CO., LTD.—At a meeting of the directors, held on March 27, it was decided that a dividend at the rate of 5 per cent. per annum, subject to income tax at 4s. 9d. in the £, for the six months ending 30th inst., be paid in respect of the preference shares, and that the preference transfer books be closed from June 23 to June 30 inclusive.

BROKEN HILL PROPRIETARY CO., LTD.—The ordinary general meeting of the shareholders will be held in Melbourne on August 31. The business will be the consideration of the directors' report and the election of directors (Messrs. R. O. Blackwood and H. V. McKay) who retire, but are eligible, and offer themselves for re-election; also re-election of auditors.

UNITED TURKEY RED CO.—The directors announce that, in view of the loss shown by the accounts at December 31 last, they have decided to postpone consideration of payment of the dividend on the second cumulative preference shares until the result of working for the current six months is before them. The dividend on the first cumulative preference shares will be paid.

BORAX, CONSOLIDATED, LTD.—The transfer books of the first mortgage debenture stock will be closed from June 18 to 30, inclusive, for the preparation of the warrants for the half-yearly interest due on July 1. Coupon No. 48 of the debenture stock warrants to bearer will be paid, less income tax at 4s. 9d. in the £, on and after July 2, at the offices of the company, 16, Eastcheap, London, E.C.3.

BLEACHERS' ASSOCIATION LTD.—The directors state that the past year's working to March 31 last shows a net profit of £788,465, and, including £359,405 brought forward, the available balance is £1,147,870. A final dividend is recommended of 15 per cent., making 20 per cent. for the year, placing £125,000 to the general reserve and £50,953 to the superannuation fund, leaving £361,712 to be carried forward. For the preceding year the dividend was 12½ per cent.; for 1920–21, 10 per cent.; and for 1919–20, 20 per cent. (including a 5 per cent. bonus) was paid.

RHODESIA COPPER AND GENERAL EXPLORATION AND FINANCE CO.—The report for the year to March 31 last states that the income derived from interest, investments, and rents amounted to £12,336, and the profit from land sales and investments realised to £9,151, making a total of £21,487. After deducting expenditure and depreciation, the profit and loss account shows a credit balance of £18,325, which, added to the amount brought in, makes £21,071. The directors recommend a dividend of 10 per cent., less tax. Meeting, Cannon Street Hotel, on June 20, at noon.

BENZOL AND BY-PRODUCTS LTD.—The directors state that in order to place the company upon a sound basis, with its capital represented by tangible assets, they recommend writing down those of the assets which have depeciated. It is estimated that the sum required will amount to 50 per cent. of the issued ordinary shares, by which amount it is proposed to reduce the capital. In addition, it is proposed to reduce the interest on the 10 per cent. cumulative preference shares to 6 per cent., holders being granted participation rights, but forgoing the two years of interest which has accrued to March 31, 1923.

ESPERANZA COPPER AND SULPHUR CO.—The profit for the year 1922 was £4,335, and £4,853 was brought in, making a total of £9,188. The report states that negotiations with the Seville Sulphur and Copper Co., Ltd., of Glasgow, resulted in a scheme of amalgamation on terms considered to be satisfactory to both sides. The scheme has since been approved by shareholders and sanctioned by the Court. It is believed that, although the pyrites trade is at present in a very depressed state, the result of this amalgamation will ultimately be very beneficial to the shareholders. Meeting, Winchester House, on June 21, at 12 o'clock noon.

YORKSHIRE DYEWARE AND CHEMICAL CO.—After providing for depreciation, etc., the surplus for the year to March 31 last, including E.P.D. refunded, amounts to £42,803, and £5,443 was brought in, making a total of £48,246. After deducting interest on debenture stock and interim dividend paid, there remains £41,586. The directors recommend a dividend at the rate of 12½ per cent. (making 15 per cent. for the year, and a special bonus of 1s. 6d. per share, less tax at 5s.; adding £10,000 to the reserve and carrying forward £6,273. The directors think that reserve for extensions is no longer necessary and have transferred same to there serve fund, which, after adding the above sum of £10,000, will amount to £110,000. Meeting, Great Northern Hotel, Leeds, on June 19 at 11.30 a.m.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. No.
Belgium	Chemical and pharmaceutical products.	758
Denmark	Essences for the soap making industry, heavy and fine chemicals.	760
San Francisco ..	Shellac and varnish gums.	776
New Zealand ..	Tanning materials, paints and varnishes.	752

Tariff Changes

POLAND.—Owing to the fluctuating rates of exchange, the import duties payable in paper currency have been increased to 899,900 per cent. (multiplier 9,000) for many substances including:—Acetic acid; salts and compounds containing gold, silver and platinum; silver nitrate; all organic compounds of iodine; compounds of bismuth, bismuth oxide, basic nitrate of bismuth, bismuth salts from gallic, tannic and other acids; compounds of mercury—sublimate, calomel, cinnabar, mercuric oxide and salts thereof; wood spirit and acetone; zinc white; and organic synthetic colouring compounds.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[*NOTE.—The publication of extracts from the " Registry of County Court Judgments " does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

SIMM, Henry, The Cottage, Hartlands, Cranford, chemical manufacturer. (C.C., 16/6/23.) £34 1s. 9d. April 17.

STANSFIELD, Mr. J. D., Boothfold, Waterfoot, chemical manufacturer. (C.C., 16/6/23.) £30 3s. April 9.

TURNER DRUG AND GALENICAL CO., LTD., Roden Street, Ilford, drug manufacturers. (C.C., 16/6/23.) £42 15s. 5d. April 18.

WILSON, Joseph, 83, Caledonian Road, Leeds, manufacturing chemist. (C.C., 16/6/23.) £30 16s. May 3.

Receivership

LEVENE (HARRY), LTD. (R., 23/6/23). A. H. S. Glenton, of 20, Collingwood Street, Newcastle-on-Tyne, was appointed Receiver or Manager on June 5, 1923, under powers contained in debentures dated November 13, 1922.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

CHEMICAL ENGINEERING AND WILTON'S PATENT FURNACE CO., LTD., London, S.W. (M., 16/6/23.) Registered June 2, charge securing £900 and further advances up to £3,000, to O. H. Cooke; charged on a building agreement in respect of land at Hendon. *£5,500. December 29, 1921.

CLEMENT AND JOHNSON, LTD., London, W.C., chemists. (M., 16/6/23.) Registered June 6, £100, £100, £100, £500, £300 and £100 debentures, part of £60,000; general charge. *£38,700. January 12, 1923.

CORBYN, STACEY AND CO., LTD., London, E., chemists. (M., 16/6/23.) Registered June 4, £4,000 1st debenture and £1,500 2nd debenture (subject to 1st debenture), to W. H. Robertson and A. Howard; general charge. *£750. May 3, 1923.

SOMERVILLE (W. A.), LTD., Liscard, chemists. (M., 16/6/23.) Registered May 31, £100 4th debenture, to C. W. Pollexfen and another; general charge. *£250. August 25, 1921.

STELLA GILL COKE AND BYE-PRODUCTS CO., LTD., London, E.C. (M., 16/6/23.) Registered June 4, £25,900 debentures, part of £300,000; general charge (except uncalled capital). *£114,300. June 21, 1922.

THREADGILL ELECTRO DEPOSITS, LTD., Tipton. (M., 16/6/23.) Registered May 28, £1,500 debenture, to Mrs. L. K. Knowles; general charge. *£3,000. December 31, 1921.

WALKER (J. B.) AND CO., LTD., Hull, oil refiners. (M., 16/6/23.) Registered June 4, £8,000 debentures (filed under sec. 93 (3) of the Companies (Consolidation) Act, 1908), present issue £2,500; general charge. *£9,000. December 31, 1922.

Satisfactions

BERENGER FRÈRES, LTD., London, S.E., essential oil merchants. (M.S., 16/6/23.) Satisfaction registered June 5, £1,000, balance of amount registered February 12, 1912.

MARLEY HILL CHEMICAL CO., LTD. (M.S., 16/6/23.) Satisfactions registered June 4, £2,000, part of amount registered June 27, 1921; and £5,000, part of amount registered February 24, 1922.

MILLBAY SOAP AND NEW PATENT CANDLE CO., LTD. (late NEW PATENT CANDLE CO., LTD.), Plymouth. (M.S., 16/6/23.) Satisfactions registered June 2, £33,000, outstanding July 1, 1908; and £5,000, registered December 6, 1912.

London Gazette

Bankruptcy Information

GANDY, Charles Johnson, carrying on business at Back Strawberrydale Avenue, Harrogate, as THE DANDY POLISH CO., polish manufacturer. (R.O., 16/6/23.) Receiving order, June 5. Debtor's petition. First meeting, June 22, 2.30 p.m.; and public examination, June 28, 2.30 p.m., Court House, Raglan Street, Harrogate.

MUSGRAVE, Herbert, carrying on business under the style of JOHN MUSGRAVE at Grove Dye Works, Meanwood Road, Headingley, Leeds, dyer. (R.O., 16/6/23.) Receiving order, June 6. Debtor's petition.

Company Winding Up

CARLTON BLEACHING AND DYEING CO., LTD. (C.W.U., 16/6/23.) Meetings, June 22, of creditors, 2.30 p.m., and contributories, 3 p.m., Official Receiver's Offices, 4, Castle Place, Nottingham.

Company Winding Up Voluntarily

LONDON BRONZE POWDER CO., LTD. (C.W.U.V., 16/6/23.) Frederick Richard Maddox, 28, Budge Row, E.C., accountant, appointed liquidator.

New Companies Registered

CORNWALL PORCELAIN CLAYS, LTD., Bull Ring, St. Austell, Cornwall. To quarry, search for, and deal in china and ball clay, china stone, felspar, etc. Nominal capital, £35,000 in £1 shares (27,500 ordinary and 7,500 5 per cent. non-cumulative preference).

ELECTROMET SOAP CO., LTD., 30, Queen Street, Manchester. To carry on business as indicated by the title. Nominal capital, £10,000 in £1 shares.

FOREST CHINA CLAY WORKS, LTD. Proprietors of china clay mines in all its branches. Nominal capital, £5,000 in £1 shares. A subscriber: D. G. Collins, 118, Newgate Street, London, E.C.

MAGUIRE, PATERSON, AND PALMER, LTD., Fairfield Works, Bow, E.3. Manufacturers of matches, etc. Nominal capital, £500 in £1 shares.

VALDOR SOAP MFG. CO. (NOTTINGHAM), LTD., 15, St. Mary's Place, Nottingham. Soap, glycerine and tallow manufacturers and refiners; soap merchants and factors; manufacturers of and dealers in chemical, medicinal, and toilet articles, etc. Nominal capital, £1,000 in £1 shares (500 7 per cent. cumulative preference).

H. O. WOODHEAD, LTD., 41, Castle Street, Liverpool. Wholesale, retail, or manufacturing chemists, druggists, and drysalters. Nominal capital, £1,000 in £1 shares.

"Chemical Defence" in Russia

ACCORDING to an article in the *Times* by their Special Correspondent lately returned from Moscow, a Gas and Anti-Gas Service has been elaborately organised in the Red Army under the name of Chemical Defence, and the headquarters of this Service is attached to the Commander of Artillery, G.H.Q., Moscow. In each military district there is a section of chemical defence attached to District Artillery Headquarters, while similar sections exist at Divisional, Brigade, and Regimental H.Q.'s. On paper the whole programme is wonderful. The most precise and ample arrangements are made for (1) experiments; (2) manufacture; and (3) training; but in practice the experiments do not amount to much; the manufacture of gas on any large scale is not being carried on; there are few instructors, and these instructors are careless. Here, as in other things, the absence of technical material prevents the Bolshevists from being quite as wicked as they would like to be; and their suspicion of foreign spies has prevented them, so far, from employing German experts.